FIELD MUSEUM OF NATURAL HISTORY BULLETIN

January 1989

World Music Programs

Weekends in January

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Field Museum of Natural History Bulletin

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COVER

Chilean bat, *Stenoderma chilensis*, from a drawing in *Atlas de la Historia Fisica y Politica de Chile*, by Claudio Gay, vol. II, Paris, 1854. The two-volume set is in the Field Museum's Mary W. Runnells Rare Book Room.

Stenoderma chilensis was described by Gay from the arid northern region of Chile in 1847. Because it has never been observed in nature and there are no specimens of this form, its existence has long been held in doubt. The distinctive nose leaf, "epaulettes" on the shoulders, and lack of a tail membrane identify this animal as a member of the fruit bat genus *Sturnira*, widely distributed in wet tropical America but unknown along the dry Pacific slope of the Andes. Recently, populations of this genus were discovered in arid western Peru by Victor Pacheco of the Javier Prado Museum in Lima; these may be related to the enigmatic form described by Gay. In 1986, Pacheco came to Chicago and began study of the evolutionary relationships and distribution of *Sturnira* with Field Museum curator Bruce D. Patterson, using the Museum's superb Neotropical collections. He has just completed a master's program at the University of Illinois, Chicago, in which he has learned a variety of new biochemical, anatomical, and statistical techniques. On his return to Peru, these new techniques and skills will be passed on to a new generation of Peruvian scientists.

For information on Illinois bats, see pages 6-15.

Cover photo (from Claudio Gay's book) by June Bartlett GN-85241

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EVENTS

Winter Fun, Children's Workshops 1989

BEAT THE WINTER BLUES! Treat your children (or grandchildren) to weekend workshops at Field Museum. Workshops begin January 21 through February 18. Children ages 4-13 can participate in classes that range in topics from sharks, fossils, and dinosaurs to the fascinating culture of the Ancient Egyptians.

Anthropologists, biologists, artists, and storytellers bring their creative energies and expertise to this winter's workshops. Advance registration is required. See the new Adult, Children, and Family Program Brochure for a complete schedule and registration form or call (312) 322-8854, Monday through Friday, 9:00am-4:00pm for further information. Workshops fill quickly so be sure to get your request in now. Advance registration is required.

Adult Courses

ADULT COURSES BEGIN again the second week of February. Selections include *The Incas and Their Ancestors, Conversational Spanish* and *Owls of North America.* Weekend workshops feature *Caring for Your Books, Chinese Brushstroke, An Herbal Sampler,* and *Mexican Tapestry Weaving.* Check the January/February/March program brochure for details on these and many other adult courses. Call (312) 322-8854 if you have questions or need another brochure.

World Music Programs

Weekends in January
1:00pm and 3:00pm

Program highlights include:

☐ *January 7 and 8*
1:00pm—Chinese Music Society of North America demonstrates instruments from the Chinese orchestra
3:00pm—Douglas Ewart plays Japanese bamboo flute

☐ *January 14 and 15*
1:00pm—Raices del Ande performs Bolivian and Latin American folkloric music
3:00pm—Shanta tells African stories

☐ *January 21 and 22*
1:00pm—Eli Hoenai demonstrates African percussion
3:00pm—Darlene Blackburn demonstrates African dance

☐ *January 28 and 29*
1:00pm—Fan Wei-Tsu demonstrates the sheng, a Chinese zither
3:00pm—Librado Salazar plays classical guitar

The World Music Program is supported by the Kenneth and Harle Montgomery Fund and a City Arts IV grant from the Chicago Office of Fine Arts, Department of Cultural Affairs.

Weekend Programs

Each Saturday and Sunday you are invited to explore the world of natural history at Field Museum. Free tours, demonstrations, and films related to ongoing exhibits at the Museum are designed for families and adults. Listed below are some of the numerous activities offered each weekend. Check the activity listing upon arrival for the complete schedule, and program locations. The programs are partially supported by a grant from the Illinois Art Council.

January

7 12:30pm *"Museum Safari"*
Trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon, big game from Africa, and seals from the Arctic.

21 12:30pm *"Museum Safari"*
Trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon, big game from Africa, and seals from the Arctic.

These programs are free with Museum admission and tickets are not required.

The City Musick Performs January 20

The City Musick, Chicago's highly acclaimed eighteenth century orchestra, presents concerti for diverse instrumental combinations by Antonio Vivaldi, 8:00 Friday evening, January 20, in Field Museum's James Simpson Theatre. Ticket prices are $20 and $16 with a 10% discount for Field Museum members. Call City Musick at 642-1766.

ILLUMINATIONS
A BESTIARY

Enchanting Photo Exhibit Explores Back Rooms of Museums

On View through February 26

What natural and artistic phenomena lurk in the back rooms of natural history museums? What unseen enigmas are locked away from the public eye? "Illuminations: A Bestiary," a compelling and highly unusual collection of color prints by photographer Rosamond Wolff Purcell, will be on display at Field Museum until February 26. The exhibit features fascinating photographs of preserved animal specimens taken for a book Purcell published in collaboration with noted Harvard paleontologist and evolutionary biologist Stephen Jay Gould. These captivating photos explore the living world in a novel way, far removed from the traditional photographic essays associated with natural history.

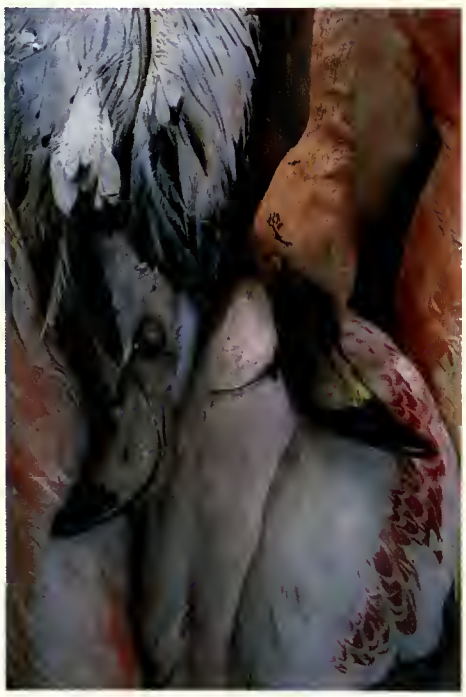
Purcell combed the back rooms of numerous museums searching for skeletons, fossils, and preserved animal specimens to serve as her subjects. "It is amazing how the light of day falling on these animals can banish feelings of squeamishness and fear." says Purcell. "Whether photographing a fossil tooth, a desiccated monkey, or a bog woman, I feel a sense of privilege and responsibility. We have devised peculiar rites for animals in natural history museums. . . inscriptions on bones, chemical baths to render them translucent . . . I think of these treatments as forms of burial, but I think of the animals as expressing in various ways, life after death."

One aspect of the exhibit questions the life often drawn between art and science. Purcell's specimens were chosen for the artist's personal reasons of curiosity and appeal. They were chosen for their visual power, beauty, and potential for human reference rather than for scientific significance. Many of the photos in the exhibit are accompanied by Stephen Jay Gould's eloquent prose. The scientist, taking his cue from the artist's interpretation, elaborates first on the specimen's scientific characteristics and then invites the viewer to speculate on other meanings such as evolutionary changes, social constructs, and even moral messages. The complex interaction between the image and the text (the subjective and the scientific) is a prevailing motif throughout the exhibit.

For the most part, Purcell's photos were taken with natural light in their various "museum" settings of chemicals, cotton, jars, and flasks. A richly colored photo of a gannet's skull is typical of the surrealistic quality the images in this exhibit possess. The skull is seen in double as the camera captures the reflection created by a bell jar placed above the bird's skull. The photo suggests characteristics about the skull that science would not substantiate. A dramatic shot of an ancient mastodon's tooth, protected on cotton wool, resembles the startling panoramic view of a mountainous terrain. Other compelling compositions of fish skulls form pleasing and intricate patterns as they seem to engage in animated dialogue with one another.

Rosamond Wolff Purcell's photographs have appeared worldwide in exhibitions, magazines, and books. Stephen Jay Gould is the author of numerous best selling books on evolution and natural history. The two are currently collaborating on a second publication and several photos taken for this project will be included in the Field Museum exhibit.

The exhibit *"Illuminations: A Bestiary"* will be free with regular Museum admission. The book of the same title from which the exhibit derives is on sale in the Museum store for $19.95 (10 percent discount for members).



"Flamingos" from the exhibit "Illuminations: A Bestiary"

Legends in Stone, Bone, and Wood

On view through February 19

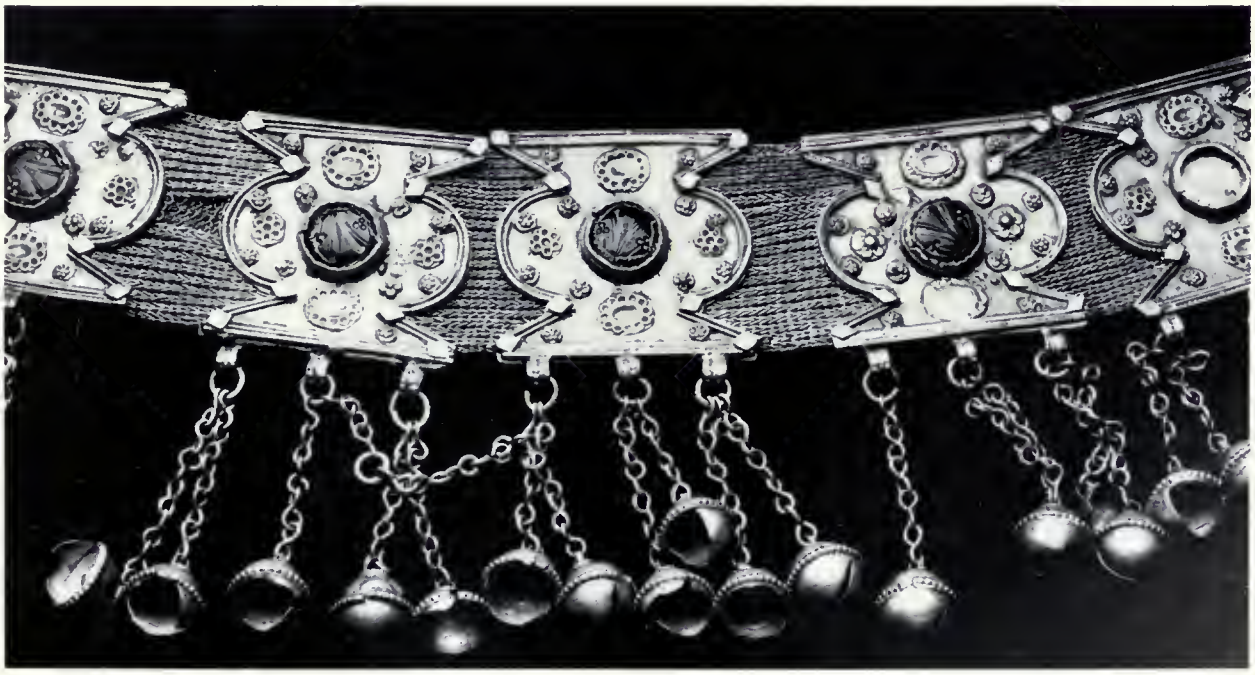
Contemporary Native American art is featured in a new exhibit at Field Museum titled "Tsonakwa and Yolaikia: Legends in Stone, Bone, and Wood." The husband and wife artist team of Gerard Rancourt Tsonakwa and Yolaikia Wapitaska display their work in a fascinating exhibition of colorful wooden masks, stone sculptures, and carved miniatures from antlers. The art is accompanied by wall panels bearing Indian legends and commentaries about animals, people, and spirits represented. Tsonakwa and Yolaikia are Abenaki Indians from the province of Quebec. Many of the social and spiritual traditions embedded in their heritage are reflected in their work. The exhibit will run through February 19.

Mask made by Rancourt Tsonakwa and Yolaikia Wapitaska

TRADITIONAL CRAFTS OF SAUDI ARABIA

On view through March 12

An authentic goat-haired tent that once sheltered a family of nomadic people in the desert of Saudi Arabia, stands as the centerpiece of a special new exhibit at Field Museum entitled "Traditional Crafts of Saudi Arabia." The exhibition highlights the personal collections of John Topham, an American engineer who worked and lived in Saudi Arabia during the 1970s. This unique collection of textiles, clothing, jewelry, weapons, and household utensils, represents the first comprehensive display of Saudi Arabian crafts to be seen in Chicago. The exhibit captures the beautiful achievements of a vanishing culture and reflects the artistic tradition of Saudi Arabia where artifact and artwork are one. "Traditional Crafts of Saudi Arabia" will be on display through March 12.



Section of woman's silver belt with engraved glass insets, made before 1940. On view in exhibit "Traditional Crafts of Saudi Arabia."

Burton Cave, Pike County, a protected habitat for the Indiana bat. | E. Gardner

THE BATS OF ILLINOIS

by James E. Gardner and David A. Saugey

BATS INHABIT ALL OF EARTH'S terrestrial regions, except the polar areas and extreme desert. More than 1,000 species are found worldwide, with 40 species in the continental United States and 12 in Illinois.

They are the most important predators of night-flying insects. More than 70 percent of the world's bat species are insectivorous, and most consume over half their body weight in insects nightly. A single little brown bat *(Myotis lucifugus)*, a species common throughout Illinois, can consume up to 900 insects in an hour.

A common misbelief is that bats attack humans. Another popular miconception is that all bats are rabid but don't suffer from the disease themselves, and therefore are important reservoirs of the disease among wild animals. None of these beliefs, however, has any basis in fact. Bats do not attack people even when provoked (though some will bite in self-defense if picked up) and less than one half of one percent of all the bats in the world contract rabies. Those that do suffer the disease die from its effects. Fewer than ten cases of rabies in the United States and Canada in the past 40 years have been attributed to rabies. By way of contrast, more people die annually from bee stings or from attacks by their own pets.

Bats are extremely valuable in medical research because of their unique morphological and physiological adaptations as flying mammals. Most have highly

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"The Bats of Illinois" is adapted from "Aerial Acrobats of the Evening Sky," by David A. Saugey, which appeared in the November/December 1988 issue of *Arkansas Game and Fish*, published by the Arkansas Game and Fish Commission. David Saugey is a wildlife biologist with the United States Forest Service. Mr. Gardner, who serves the Illinois State Natural History Division as assistant research biologist, Section of Faunistic Surveys and Insect Identification, emended and adapted Mr. Saugey's article with respect to the bat species found in Illinois.

sophisticated sonar (echolocation) for navigating and catching prey; they are exceptionally long-lived and resistant to many diseases. Bat research has contributed to the designing of navigational devices for the blind and aided in the development of vaccines and techniques for birth control and artificial insemination. Bats have been used to test the effects of new drugs on bacteria and other microorganisms in blood and in investigating the effects of drugs and alcohol on blood vessels and nerves, on muscle regeneration, and on tissue repair. How ironic that the cliché "blind as a bat" refers to an animal that allows us to "see" so much. For the record, most bats have good eyesight!

Unlike some mammals, bats are true hibernators. In Illinois, they find a suitable environment in caves and abandoned mines from mid-September through early November. Living on deposits of stored fat, they can reduce their basic metabolic rate (BMR) to a level at which breathing and heartbeat are almost imperceptible. When disturbed bats are awakened from hibernation, they increase their BMR, exhausting precious fat reserves. The disturbance of hibernating bats can thus result in starvation and death before insects are again available as a food resource.

Evening bat J. E. Gardner

Hoary bat © 1987 A. H. Rider The National Audubon Society Collection/PR

In Illinois, most bats mate in autumn before entering hibernation or during migration. The females don't become pregnant, however, until hibernation ceases in the spring. In this reproductive pattern, known as delayed fertilization, sperm remain viable and are nourished by specialized cells in the female's reproductive tract until ovulation and fertilization occur.

Hoary bat
© Merlin Tuttle, The National Audubon Society Collection PR

Young bats, called pups, are generally born between late May and early June. Depending upon the species, bats may have a single pup or up to five in a litter. Females are very attentive mothers, grooming and nursing their pups until they can fly and forage on their own—about 21 to 30 days after birth.

Like many other animals, bats worldwide are seriously threatened by human activities. The worst threats to bats are loss of habitat, disturbance by humans, and poisoning from pesticides. Fortunately, all bats in Illinois are protected by law, but the Indiana bat, the gray bat, the southeastern bat, and Rafinesque's big-eared bat are classified as state endangered species by the Illinois Endangered Species Protection Board. The Indiana bat and the gray bat are also listed as federally endangered species by the U.S. Fish and Wildlife Service. The Illinois Natural History Survey,

the Illinois Department of Conservation, and the Illinois Department of Transportation are involved in cooperative research programs studying the distribution and ecology of Illinois bats, with emphasis on learning more about such endangered species as the Indiana bat. Everyone can help protect and preserve bats simply by leaving them alone and avoiding the disturbance or destruction of their habitat.

Habitats for Illinois bats include caves, abandoned mines, bridges, trees, vacant and occupied buildings, and just about any other kind of shelter. Illinois bats are grouped into two categories, tree bats and cave bats, depending upon the type of shelter (known as roosts) they use as well as their respective requirements and behavior, and their morphological adaptations.

Tree Bats

Tree bats are more solitary and nomadic than cave bats. They roost singly or in small family groups that consist of a female and her offspring. Tree bats migrate in response to cold temperatures and seldom enter caves or mines to hibernate. The uropatagium (the flight membrane between the legs, enclosing the tail) is more fully furred than it is in cave bats, providing added protection from the elements. For reasons not fully understood, the fur of tree bats is much more colorful than the drab brown and gray pelage of cave bats.

Evening Bat, *Nycticeius humeralis*. This ⅓-ounce, brownish evening bat lacks distinctive features and coloration. Because of its black membranes and ears, it is often mistaken for the big brown bat (see *Cave Bats*). During summer, it primarily inhabits older, abandoned buildings, although it can be found in hollow trees or beneath loose bark. Females (seldom more than 150 in a group) establish maternity colonies in these habitats and produce a single litter that characteristically has two pups. Although this species has been reported throughout Illinois, including Chicago, during the summer, it is encountered very infrequently.

The evening bat is apparently absent from Illinois during the winter, but its winter range outside the state is virtually unknown. This bat accumulates large fat reserves in autumn, reserves that are sufficient for hibernation or a long migration.

Hoary Bat, *Lasiurus cinereus*. The largest and most colorful bat in Illinois, the hoary bat, has a wingspan of up to 16 inches and weighs more than 1½ ounces. Many of its hair tips are white, giving a frosted or hoary appearance. Females are much larger than males and give birth to two pups among the foliage of trees. Seldom seen by most people, this heavily furred bat occurs statewide during spring and summer.

A strong, fast flyer, the hoary bat is an accomplished migrant. Often moving in large groups, these bats spend the winter in the southeastern United States, Mexico and Guatemala, although they have been reported from Indiana and other more northern states during winter months. Generally absent from Illinois during winter, this bat is sometimes found on lawns or sidewalks either dead or near death after autumn migrations that proved too strenuous or too hazardous.

Red Bat, *Lasiurus borealis*. This beautiful, medium-sized bat can be bright red-orange to yellow-brown. It weighs up to ½ ounce and has an 11- to 13-inch wingspan. A very common species in Illinois, the red bat can be found in virtually every county during the summer. Solitary bats roost in daytime retreats near the ground among the leaves of trees or shrubs. Several red bats were once found hanging together on the underside of a sunflower leaf. Perhaps more than any other bat species, it feeds on insects attracted to lights.

Females typically have a single litter of three pups, occasionally as few as one or as many as five. Blue jays prey on their flightless pups (and on those of all other bat species) as do crows and snakes. Red bats are unique among Illinois bats in that males can be easily distinguished from females by their much more reddish pelage.

Very little is known about wintering sites of red bats, but they probably hibernate in trees in southern states. Like their close relative the hoary bat, they are sometimes found during autumn migrations and can often be seen flying in late afternoon on warmer winter days.

Silver-haired Bat, *Lasionycteris noctivagans*. Weighing less than ½ ounce, this medium-sized bat has a bearlike face and beautiful dark, silver-tipped fur on its back. It can be found in forested habitats throughout Illinois; however, its occurrence in Illinois can be considered sporadic and its exact status remains unknown. A typical day roost for this bat is under loose bark, but some have been found in hollow trees, woodpecker holes, birds' nests, and even mines. Females typically give birth to two young, but almost nothing is known about the summer maternity roost sites of females.

Silver-haired bats apparently do not migrate great

Red bat © 1979 L. West. The National Audubon Society Collection PR

distances. During spring and autumn migrations, they are occasionally found clinging to the sides of houses or outbuildings. During a November migration in 1972, a large number of silver-haired bats, apparently confused, were killed along with a number of warblers when they flew into Chicago's McCormick Place, just south of Field Museum.

Cave Bats

Unlike tree bats, cave bats hibernate during winter in caves or other cave-like environments such as abandoned mines. Cave bats have a hairless uropatagium and rely heavily upon caves for protection from winter temperatures. They are generally much more social than tree bats, often forming groups of thousands. Because they group in such large numbers, in relatively small areas, cave bats are far more vulnerable to human vandalism or natural adverse conditions than are the more solitary tree bats.

"Clustering" behavior is carried over into the summer when cave bats form maternity colonies, although

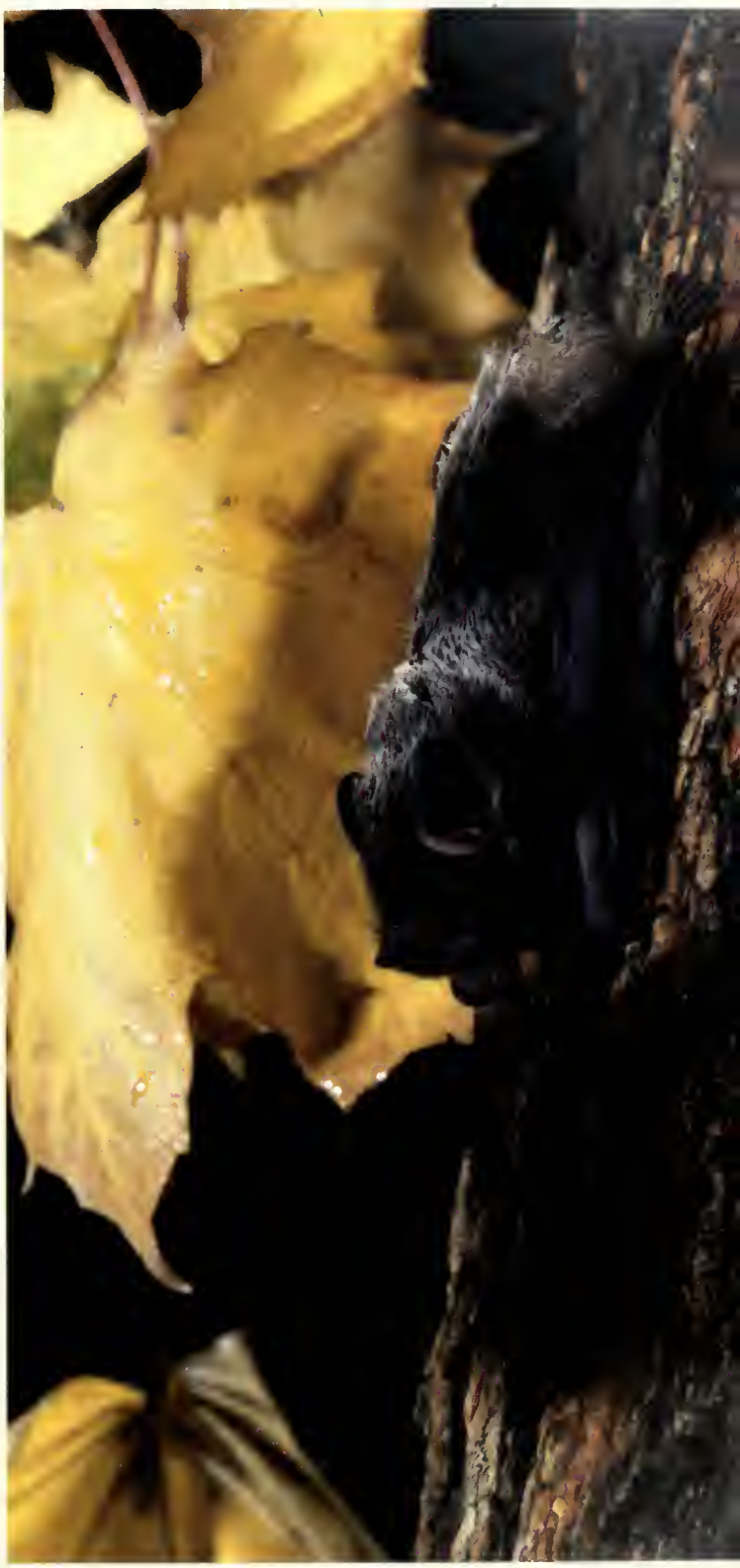
these are usually of considerably fewer individuals than hibernating clusters. In Illinois, the gray bat and the southeastern bat are the only species whose females remain in caves to bear their young; all other cave bat species in Illinois establish maternity colonies in buildings, trees, or other structures.

Little Brown Bat, *Myotis lucifugus*. This small bat has an 8- to 10-inch wingspan and weighs about ⅓ ounce. Its sleek, glossy fur ranges from pale tan to reddish or dark brown. Easily confused with several other species of myotine, or "mouse-eared" bats, the little brown bat is very common throughout Illinois during the summer. Females establish large maternity colonies in buildings and give birth to one pup yearly. Males are solitary or live in small bachelor colonies. Following hibernation, this species is rarely found in caves; but without a doubt, little brown bats far outnumber any other species of hibernating bat in Illinois during winter, with clusters sometimes numbering in the tens of thousands.

Accordingly, little brown bats have been one of the most frequently studied species, and they are still a favored subject. Long-term studies of the movements of little brown bats from an abandoned mine in north-central Illinois have given us much insight into the natural history of this species.

Gray Bat, *Myotis grisescens*. Typically weighing less than ⅓ ounce, this bat is usually uniformly gray in color (some are russet). It is dependent on caves for roosting habitat during both summer and winter. For this reason, it has never been common in Illinois and has been reported almost entirely from regions with natural caves in the southern and west-central portions of the state. A cave in southern Illinois that once housed more than 10,000 gray bats has now been abandoned; very few of the approximately 400 caves in Illinois provide suitable habitat for this endangered species, and those that do have long since been abandoned because of habitat destruction and human disturbance, for the species is highly sensitive to disturbance. Their vulnerability is indicated by the fact that 95 percent of the entire known gray bat population hibernates in just eight caves in five states.

Maternity colonies may contain thousands of females, each bearing a single pup. These females form tightly packed clusters in dome-shaped pockets in the ceilings of caves. Female gray bats captured over the Cache River in Johnson and Pulaski counties had given birth that season and were nursing young, but their maternity site could not be found. Efforts to capture gray bats at caves they once occupied have resulted in the taking of only a few males.



Silver-haired bat © Merlin Tuttle, The National Audubon Society Collection/PR

Eastern Pipistrelle, *Pipistrellus subflavus*. The eastern pipistrelle is a small bat with fur that is orangish-tan at the tips and black at the base. The yellow-orange forearm and contrasting blackish wing membranes make it easy to identify. Referred to as "pips," these common, ⅕-ounce animals are the smallest Illinois bat. They range throughout Illinois during the summer, but only a single pip has been reported from the Chicago area and very few from other northern portions of the state. In winter, when their movement is restricted, at least one pip is commonly found in almost any cave or mine in Illinois.

black (charcoal gray) basal portions with cinnamon or chestnut tips. Often confused with the little brown bat it may be distinguished by a keel-like projection from its kalcar (heel bone). The Indiana bat can be found in almost any county in Illinois during summer. It inhabits upland and floodplain forests interspersed with openings that are usually near waterways. These bats are known from very few caves and abandoned mines in Illinois but may form dense clusters of up to 300 bats per square foot when they hibernate on cave ceilings.

Females establish nursery colonies of up to 100 adults beneath the bark or in the hollow portions of

Hibernating cluster of the little brown bat © 1982 J L Lepore The National Audubon Society Collection PR

Females occur singly or band together in small numbers during summer, when they produce their two pups. Summer roosts are virtually unknown but probably occur among the foliage of trees, in tree hollows, or beneath the bark. Pips are rarely found in buildings, but their small size and inconspicuous habits make them difficult to spot.

Indiana Bat, *Myotis sodalis*. Named for the state where it was first described, the medium-sized Indiana bat weighs only ¼ ounce and has bi-colored fur—dull

dead trees. Aided by the U.S. Fish and Wildlife Service, the Indiana Bat Recovery Team, and several cooperating state agencies, Illinois was the first state to gather comprehensive information on roost site selection, movements, home range, and activity of Indiana bats. Tiny transmitters, weighing 1/32 ounce, were glued to the backs of the bats, and their movements monitored intensively. Summertime radiotracking studies identified 45 trees throughout Illinois that were used as roosting sites.

Gray bats © 1984 Jeff Lepore. The National Audubon Society Collection-PR

The Indiana bat is a federally endangered species, and its populations continue to decline. Disturbance to hibernation sites and destruction of summer habitat are the primary causes of decline, but pesticide poisoning probably is a significant culprit. One cave and one abandoned mine in Illinois receive special protection to provide safe winter habitat for Indiana bats. Conservation measures to ensure the availability of suitable summer habitat are not easily implemented and require concerted efforts and a great deal of support from Illinois citizens.

Southeastern Bat, *Myotis austroriparius*. The southeastern bat typically weighs ⅓ ounce. It can be confused with several other species of *Myotis,* but the Illinois members of this species have woolly, dark basal fur with orangish tips. The fur on their underparts is more whitish than that on other *Myotis* and their noses are more pink. The southeastern bat is primarily a coastal species, but its range extends into extreme southern Illinois. It prefers caves and mines, from which it has been reported in southern Illinois, but it may be found in buildings or other types of shelter.

Pregnant females and females that had recently given birth were captured in mist nets set over a stream in southern Illinois during the statewide bat research project. These captures represented the first documentation that this species reproduces in the state. Previously, only males had been reported from a few caves and abandoned mines in southern counties.

This species normally produces twins, a characteristic that is unique among the *Myotis* species. Females usually establish nursery colonies in caves in much the same way as gray bats. Like gray and Indiana bats, the "social" behavior of this species has led to drastic population declines. Due to habitat destruction and disturbance by man, this species is being considered for endangered status by the U.S. Fish and Wildlife Service. It is already classified as a state endangered species by the Illinois Endangered Species Protection Board.

Keen's Bat, *Myotis keenii*. The ⅕-ounce, brownish Keen's bat is distinguished most easily from other

Eastern pipistrelle bat
©John M. Burnley The National Audubon Society Collection/PR

Banded Indiana bat study in Fogelpole Cave, Monroe County, Illinois. J. E. Gardner

Indiana bat. J. E. Gardner

myotine species by its small overall size and longer ears. Apparently distributed throughout Illinois during summer, Keen's bats have been found roosting in buildings and trees and occasionally beneath bridges. Males can be trapped almost anytime during summer at several cave and mine entrances in Illinois. Winter is spent hibernating in the colder areas of mines and caves. Individuals seem to favor crevices and other tight places as roosting spots and so are often overlooked.

Females bear a single pup, but almost nothing is known concerning the location or size of nursery colonies. One colony of 15 pregnant Keen's bats was discovered beneath the bark of a dead elm tree in Pike County, Illinois, after a male Indiana bat was radio-tracked to the tree.

Big Brown Bat, *Eptesicus fuscus*. The big brown bat is a large, brown, rather nondescript bat. Weighing from ½ to ⅘ ounces, it is second in size only to the hoary bat. One of the most common bats in Illinois year-round, it is frequently found in houses, occupied or unoccupied. Since this species has become tolerant of people and benefits from their dwellings, it is the most likely species to occur within urban areas. It has the distinctive habit of snarling when frightened or disturbed in its roost. An efficient feeder, a big brown bat is capable of filling its stomach with insects in one hour.

This species often shares maternity quarters with other species of "house bats." Favored summer roosts are attics, between walls, and beneath loose siding or

Keen's bat
© 1980 John Bova The National Audubon Society Collection/PR

other exterior coverings. Hundreds of females form maternity colonies in which each female produces two young.

Big brown bats may hibernate in the same building they occupied during the summer, but more common winter quarters are caves and mines. They normally roost singly or in small clusters; however, unusually large clusters of several hundred individuals were discovered in abandoned mines in Jo Daviess County.

Rafinesque's Big-eared Bat, *Plecotus rafinesquii*. As its name suggests, this species is easily distinguished by its large, conspicuous ears. An attractive bat, it has bi-colored gray dorsal fur and nearly white underparts. Weighing ⅓ ounce, it is at home in dilapidated houses and barns but probably uses hollow trees when abandoned structures are sparse. In Illinois, the distribution of this bat is limited to a few extreme southern counties, where almost all records are from caves and mines during winter. One nursery colony was discovered in a dilapidated cabin in Johnson County, but the bats abandoned this structure after human disturbance. Very few big-eared bats were captured in mist nets set over the Cache River during a statewide research project.

Big brown bat, 2-3 days old. David A. Saugey

Females form nursery colonies with six to several dozen adults, each producing a single pup. Males are generally solitary during nursery season and can be found behind loose bark, in hollow trees, or and in buildings. Because of its vulnerability to disturbance, the destruction of its habitat, and its limited distribution in the state, the big-eared bat has been designated a state endangered species by the Illinois Endangered Species Protection Board. **FM**

Rafinesque's big-eared bat David A. Saugey

2,000,00th Specimen Mounted by Botany Department

by William C. Burger
Curator of Vascular Plants

Plant mounters in the Department of Botany recently mounted our two millionth vascular plant specimen. As one of the world's largest museums, we have an obligation to gather materials for future study. Our strong holdings of material from Latin America makes collecting and preserving specimens from this region especially important. Tropical forests are being cut at an accelerating rate as the populations escalate. Tropical forests are poorly known and there is an urgency to sample native forest species before they are replaced by farms, pastures, and housing developments. Thanks to expeditions by Museum staff, active collecting by Latin American colleagues, and exchange of specimens from other institutions, we are adding valuable new materials to our herbarium.

Plant Preparator Birthel Atkinson mounts two millionth plant specimen.
June Bartlett 85193

Vascular plants include the flowering plants, ferns, conifers, and their relatives. Our collections also include many nonvascular plants, such as mosses, algae, fungi, and lichens. All these, together with our collections of economic plants, total about 2,500,000 specimens.

Specimens of vascular plants are generally pressed flat and dried. The flattened specimen is then glued onto a sheet of stiff high-quality herbarium paper 16½ × 11½ inches in size. A label giving the scientific name, collector, date, geographical origin, ecology, and descriptive details is also glued onto the sheet. Once the specimen is securely glued to the herbarium sheet it can be handled and studied with relatively little damage, despite its being dry and often very brittle. The mounted specimen is filed together with other specimens of the same genus and species in metal cases that hold the herbarium collections.

Dried plant specimens are used in a variety of ways. Artists may use the specimens to illustrate details of a particular species. Paleobotanists often compare specimens of living species with fossil remains to try and determine the correct placement of their fossils. Conservationists often use museum specimens to determine the earlier range of a declining species. Ecologists can use the specimens to determine altitudinal range or flowering and fruiting times over the entire geographic range of a species. Chemists and anatomists can re-

Plant specimens collected in the field, often thousands of miles from Chicago, are carefully prepared and packed to ensure they will be suitable for mounting when they finally arrive at the Museum.

move small portions for detailed analysis. However, the greatest use of these museum specimens is for classification.

For those who classify plants and animals, the primary task is to develop sound concepts of the species, often thought to be the basic building blocks of nature. Species are generally defined as populations of plants or animals that do not interbreed with other similar plants or animals. While this is a fine conceptual basis for a species definition, it is difficult to apply in practice. For the vast majority of plant species, especially in the tropics, we look for morphological discontinuities in groups of related species. If two closely similar species consistently differ in minor characteristics (and there do not seem to be any intermediate specimens) we can be quite confident that they are not interbreeding. It is for this reason that the comparison of large suites of specimens are essential for determining and defining species correctly. Thus, the primary use of our specimens is by taxonomists in their work of defining species and understanding relationships.

A question that often arises about our holdings is whether we have more than one specimen of the same species. The answer is that in the case of all but the rarest species we do indeed have many specimens of the same species. Collectors in the field have no way of knowing what the Museum already holds, and they may not know the identity of many of the specimens they collect. It is thus inevitable that many species are represented by a suite of specimens, collected over many decades and over a large area. The value of these multiple collections is that they are central to dealing with a wide variety of problems, from those of taxonomic classification to those of biogeography and ecology. Once a species is properly defined, large numbers of specimens will tell us over what geographical area the species occurs, in what kind of habitat it grows, when it flowers and fruits, how it varies over its range, how people use it, and other bits of information.

In effect, the herbarium is a "library" of dried plants; and, as in the case of libraries, the larger the number of specimens, the greater is the information content. But there is a serious problem in our herbarium: misidentified specimens can result in serious misinformation. It is not uncommon for a misidentified specimen to be found in a region or at an altitude where the species whose name it carries has never been found before. Misidentification is a common probem among the plant collections for several reasons. For one thing, higher plants number in the tens of thousands for most continental areas. The sheer number of species invites error and confusion. In addition, plants are highly variable. Leaves can differ greatly on different plants of the same species, or even in the same individual under differing environmental conditions. Specimens with flowers (and without fruit) can be difficult to correlate with specimens of the same species with fruit (but lacking flowers). Since a great many of our specimens come from tropical areas where many species are still poorly defined, our herbarium suffers from more than its share of misplaced specimens. It is for this reason that we welcome loan requests by researchers working on a particular group. We send about 25,000 specimens out on loan each year and we trust that they will come back in better order than when we sent them.

Recently, the National Science Foundation increased its support of our loan and curatorial activities, helping us to continue serving the scientific community. Our two millionth vascular plant is a small milestone in a continuing responsibility. **FM**

VOYAGE to the MOON (of Mars, that is)

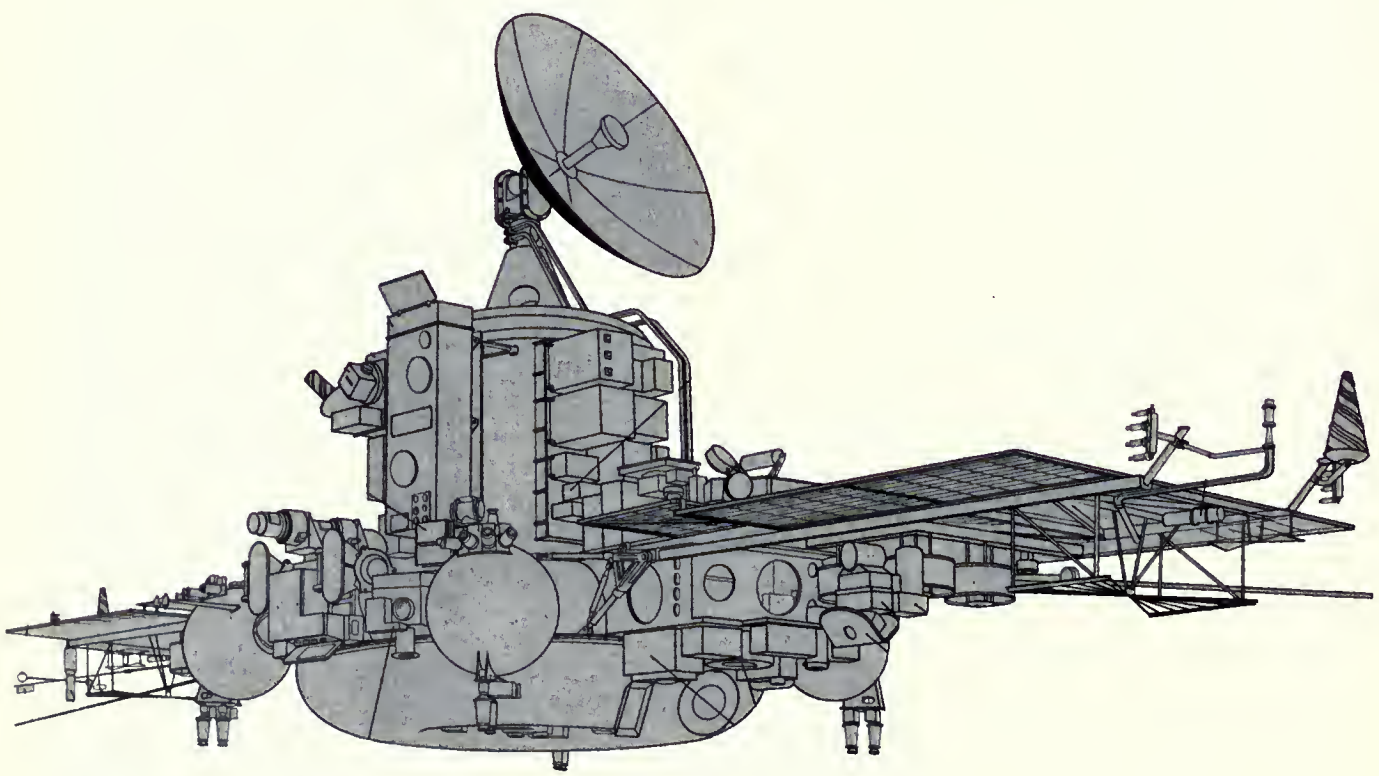
by Edward Olsen
Curator of Mineralogy

"He spake, and summoned Fear and Flight to yoke his steed and put on his glorious armor."
—Homer's *The Iliad,* Book XV

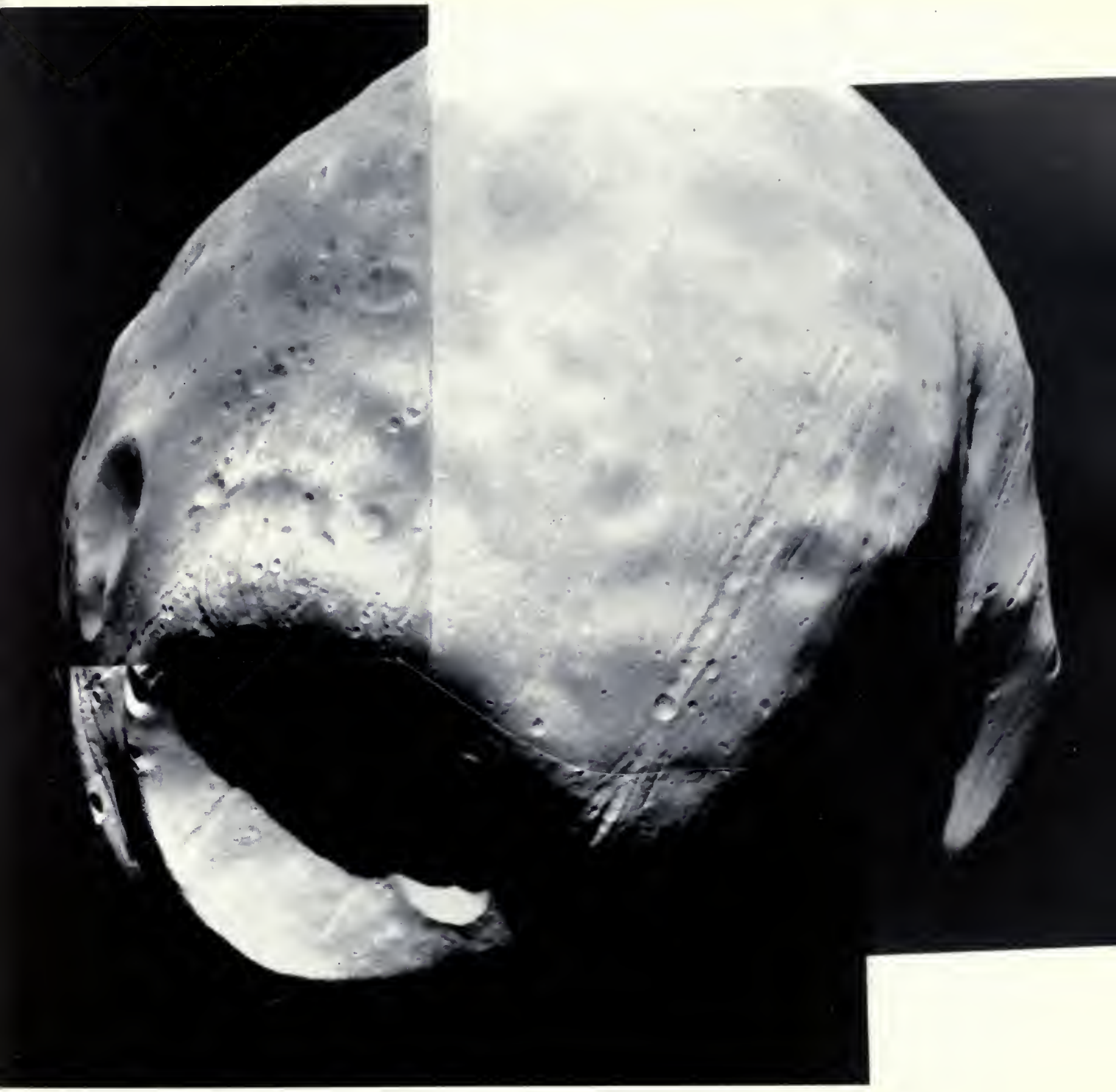
Here, Homer tells the legend of Mars, the ancient Greek god of war. To avenge the death of his son he prepares to descend upon the Earth to strike its inhabitants with fear (Deimos) and drive them to flight (Phobos).

The American astronomer Asaph Hall first discovered the two tiny moons that circle the planet Mars 111 years ago (August 16 and 17, 1877). Mars had called upon Fear and Flight (*Deimos* and *Phobos,* in Greek) so it seemed appropriate for Hall to give the names Deimos and Phobos to the two small companions of the planet Mars.

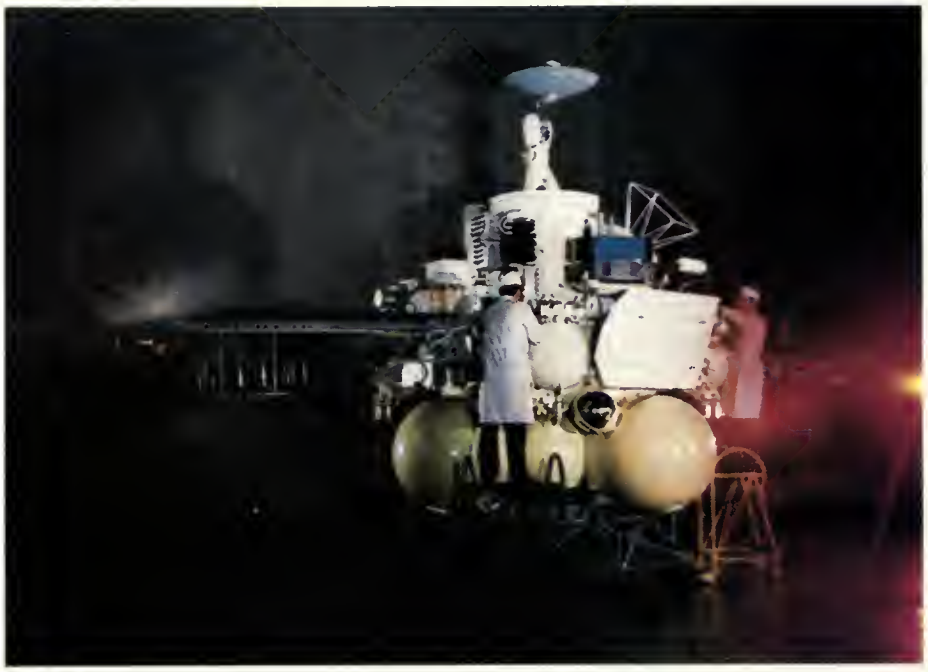
Off and on for over a hundred years, searches had been made for a moon (or moons) around Mars. No one had found them, so the expert opinion was that Mars had none. That didn't seem strange, for only Earth, among the three inner planets, had any moons. It actually seemed odd that the Earth does have one.



18 The Phobos spacecraft. The two landers are not shown.

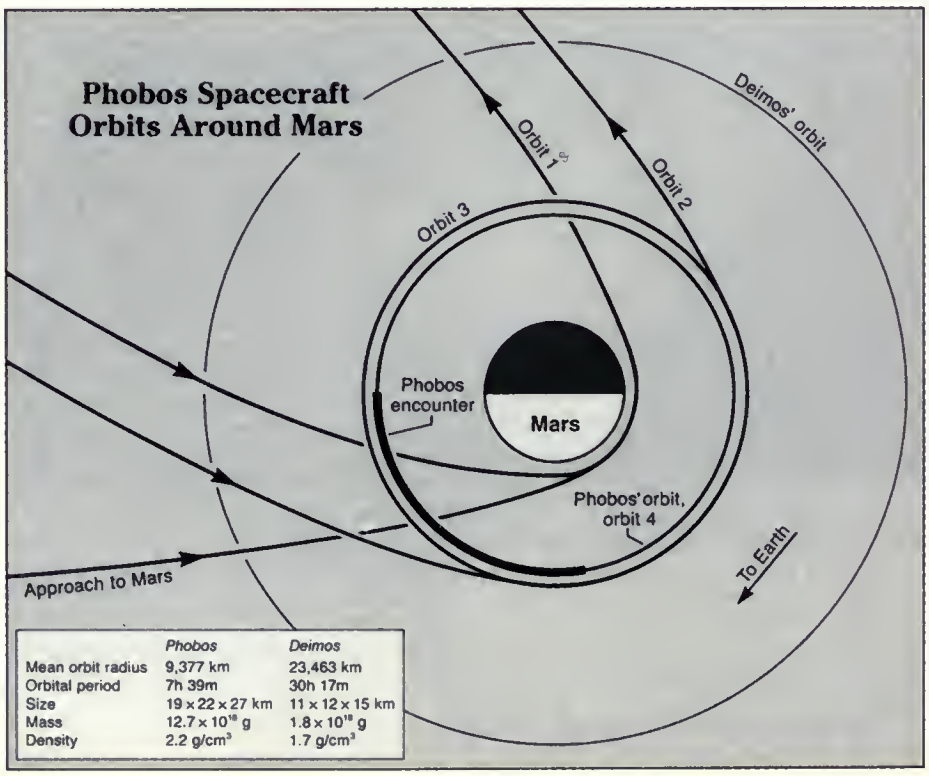


Phobos photographed at a distance of 380 miles in 1978 by Viking Orbiter I during the spacecraft's 854th revolution around Mars. The photomosaic shows the side of Phobos which always faces Mars. The largest crater is 10 km across. Courtesy NASA

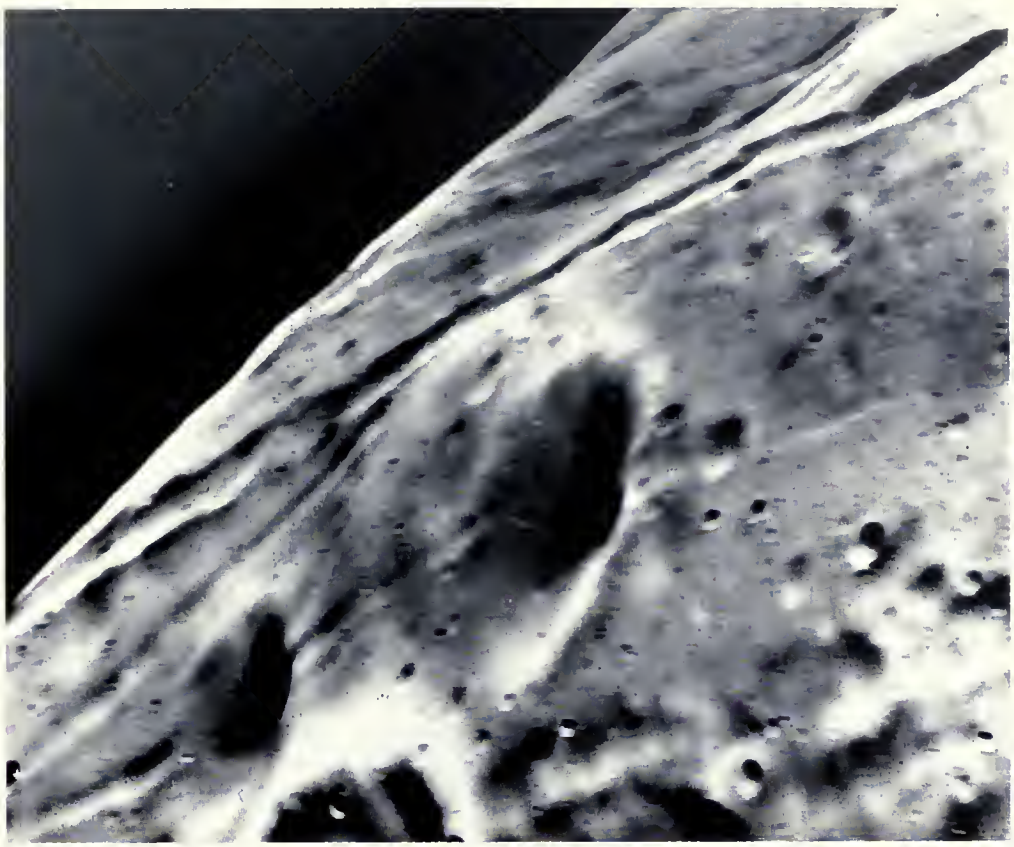


Full-scale mock-up of the Phobos spacecraft displayed at the 1987 Paris Air Show. Courtesy Sovfoto

Beyond the orbit of Mars lie several belts of orbiting asteroids, and they separate what is called the *Inner Solar System* from the *Outer Solar System.* The Inner Solar System contains the solid rock planets, Mercury, Venus, Earth, and Mars. The asteroids themselves are solid rock planets, but are very small; the largest is only 300 miles in diameter, and they range downward to gravel-size bits and pieces. There are thousands of them. But, beyond them, the Solar System takes on a very different aspect. The planets of the Outer Solar System are giants—Jupiter, Saturn, Uranus, and Neptune. Only little Pluto, with its weird orbit, may be a solid rock body like the inner planets. Jupiter, Saturn, Uranus, and Neptune, are enormous balls of gases, roil-



	Phobos	*Deimos*
Mean orbit radius	9,377 km	23,463 km
Orbital period	7h 39m	30h 17m
Size	19 x 22 x 27 km	11 x 12 x 15 km
Mass	12.7×10^{18} g	1.8×10^{18} g
Density	2.2 g/cm^3	1.7 g/cm^3



Detail of Phobos photographed at a distance of 75 miles by Viking Orbiter I in 1977. The largest crater shown here is 1.2 km across.
Courtesy NASA

ing in continuous storms. Down deep in their interiors there *might be* solid rock, but no one knows. They could just as easily be gaseous.

These outer planets, however, are rich with moons. Jupiter has 16, Saturn more than 17, Uranus 15, and Neptune a minumum of 3. There is a hint that even little Pluto has at least one moon. Among the inner planets, as already mentioned, the Earth is unusual for having a moon at all, and especially for having a moon that is so large relative to the size of Earth itself. If you add up all the masses of the moons of Jupiter, for example, they total up to only a fraction of one percent of the mass of Jupiter itself. The same is true for each of the other giant outer planets. Earth's moon, however, is over one percent of the mass of the Earth. The origin of Earth's moon is a fascinating story that has emerged from over fifteen years of analysis of the samples that were returned to Earth during the U.S. program of landings on the lunar surface—the Apollo Program. That's another story.

The two moons of Mars are very small compared to the mass of Mars. Deimos and Phobos are not spherical. Each is lumpy and irregular. Phobos looks like a giant Idaho potato. Its dimensions are approximately 17 by 13 by 12 miles (27 by 21 by 19 kilometers). Their orbits are also peculiar—peculiar, that is, in contrast to the orbit of our own moon. Our moon makes a full rotation around the Earth about every 28 days. So it takes almost a calendar month for the moon to go through all of its phases from full moon to new moon and back to full moon again. Our moon rises in the east and sets in the west. Each night it rises a little later than the night before because it has moved 1/28th of its way along its eastward orbit around the Earth. So we are used to a moon that rises and sets in the general manner of the sun, once a day.

For a person standing on the surface of Mars the two little moons offer a bizarre ballet of risings and settings. A day on Mars is just a bit longer than a day on Earth—24 hours and 39 minutes. Deimos takes 6 hours longer to go around Mars than Mars takes to go through a full Martian day. This means that Deimos moves sluggishly through the sky and, after rising, takes more than two days to set. Then it takes two more days before one would see it rise again. In the meantime, Phobos whips around Mars in a lively 7 hours and 39 minutes. On Mars, a person would see Phobos rise in the west and set in the east, twice a day.

The U.S. Viking program, initiated in 1975, sent rockets to circle Mars, photograph its surface, measure its physical and chemical properties, and drop landers onto the surface. In the process, they obtained pictures

of both Phobos and Deimos. The peculiar shapes of these moons led to speculation they could be two asteroids that passed close to Mars at some times in the distant past and were captured by its gravity field to become permanent companions. Mars is, after all, the outermost planet of the Inner Solar System and close to the belts of asteroids.

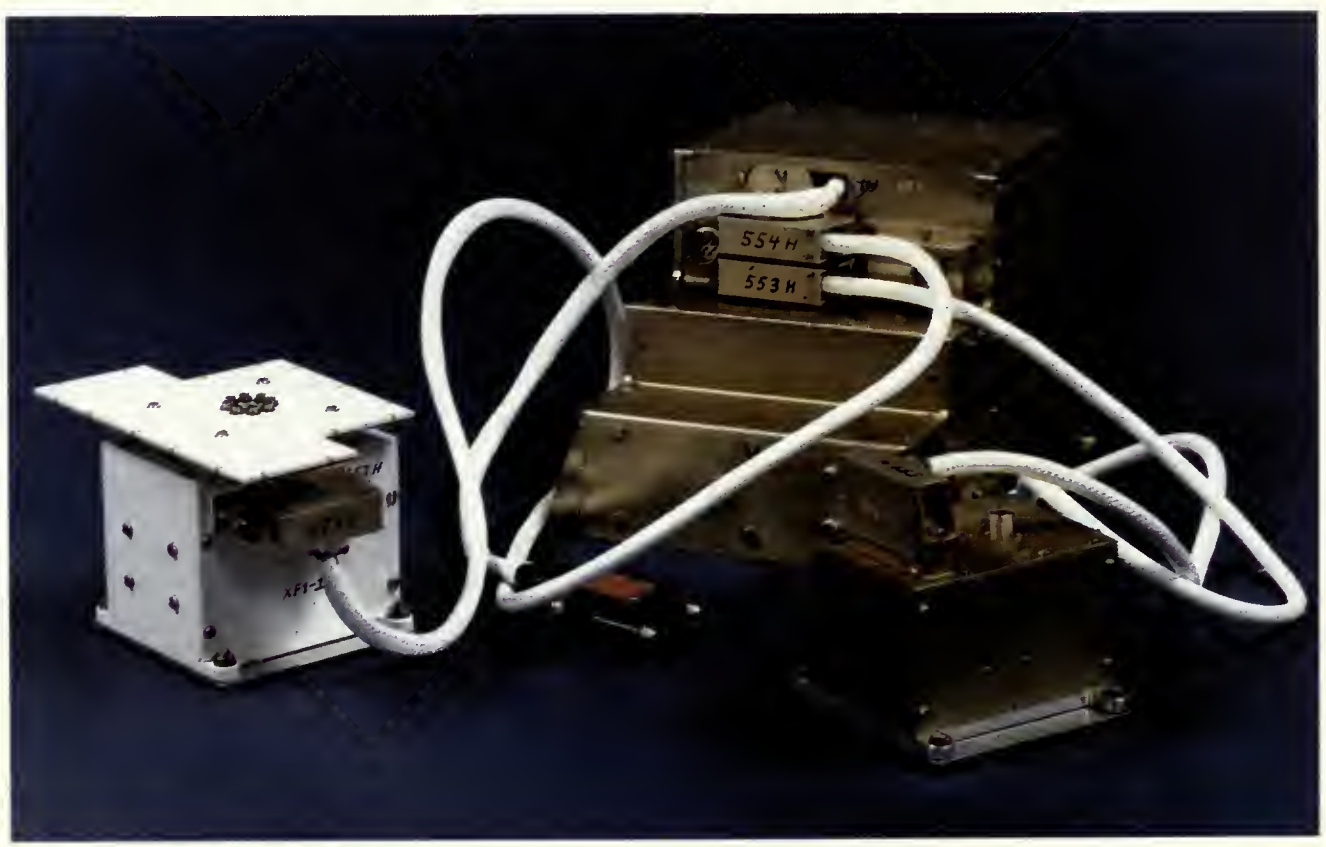
There has long been keen interest among space scientists to send a rocket to collect data on an asteroid. We know that most, but not all, of the meteorites that fall on the Earth are bits of asteroids. Altogether there are over two dozen kinds of them. It is not known whether this variety requires separate asteroids for each kind or whether some asteroids are compound types. Meteorites are very ancient matter—the oldest and most primitive objects we have from the Solar System —4,560,000,000 years old. Everything we know about the history of the Solar System we have learned from them.

Targeting an asteroid for a collecting mission is extremely difficult. First off, even a large asteroid is a very small target. Second, asteroids in the asteroid belts move along in orbits that contain thousands of them. In attempting to rendezvous with one asteroid, a space vehicle could be battered and damaged by other tiny asteroids. So, if one wants to land on an asteroid the simplest way is to go after one of the moons of Mars. Mars is a big target and easy to locate. It is out of the main belts of asteroids, so damage by passing bits of space gravel is minimized. Besides, Mars has been successfully orbited many times before. We know how to get there.

It has been known for a long time that 1988-89 is a prime time slot for missions to Mars. Because of the relative orbital motions of the Earth and Mars, the distance of approaches between them varies from as much as 63 million to as little as 35 million miles over a period of 15 to 17 years. 1988 was one of those years when Mars and Earth were only a little over 35 million miles apart, and now in early 1989 they are still fairly close together. All you have to do is look up into the southern sky on a clear night to appreciate this. Mars stands out as a bright disc with its characteristic reddish glow, almost as bright as the brilliant gleam of Jupiter.

Because the administration of the United States has decided to limit its space efforts to Space Shuttle pro-

External view of the alpha-backscatter spectrometer, which will make chemical measurements on the surface of Phobos. The device was developed by Prof. Anthony Turkevich, of the University of Chicago's Department of Chemistry and built in West Germany. Earlier versions were carried on Surveyor missions that explored Earth's moon in the 1960s. Photo courtesy A Turkevich



jects in near-Earth orbits, to a possible Earth-orbiting space station with military applications, and to military vehicles supporting the Star Wars program, no effort was made to exploit this infrequent close approach to Mars. The European Space Agency, which expended major resources to rendezvous with Halley's Comet two years ago, also did not plan any project to take advantage of this, but the Russians did.

In July of last year the Soviet Union launched two spacecraft from their Baikonur Cosmodrome in central Asia. The plan was for these craft to arrive in the vicinity of Mars in 200 (Earth) days and go into orbit around it. The orbits would be made circular and synchronous with that of Phobos. During April and May of this year landing vehicles will be deployed and these will make a series of low-velocit flybys of that little moon. The orbiters are expected to be active for at least 140 (Earth) days after the landers are released. The Soviets are not running the whole operation by themselves. Participants include scientists from Finland, West Germany, France, East Germany, Bulgaria, Austria, and the United States, which is providing ten scientists.

After the landers make their flybys they will land on Phobos's surface. The landers are of two types. One kind is to be stationary (called the DAS lander after its name in Russian). It will deploy a series of instruments to measure the chemical and physical features of Phobos. The other kind is a mobile vehicle that will move over the surface, making some of the same measurements to see if composition and physical features change from place to place. The mobile lander will move in a very odd way compared to the rover vehicles the U.S. sent to the moon years ago. Because Phobos is so small and lumpy, a rover would have serious problems moving about. The lander is this case is called a hopper. It is going to literally hop from place to place. When the hopper completes its measurements in one place, pusher legs will propel it to a new place. Each hop will carry it about 65 feet (20 meters). After a hop is completed, the hopper will bring itself into an upright position and make a new series of measurements. It is capable of making ten such hops. This kind of vehicle is practical on Phobos, which is so small its gravitational pull is very weak. It doesn't take a lot of energy to propel the hopper.

The stationary (DAS) landers are instrumented to make a greater variety of physical and chemical measurements. It is expected they will continue to make measurements for about one (Earth) year. The main part of the mission is expected to take about three months. Besides the gathering of chemical and physical data, television cameras will scan the surface, sending back high-resolution images to Earth. The project, however, isn't without its risks. What the plans are and how it all actually functions may be somewhat different. One of the Soviet scientists said recently, "It is worth the gamble, and if things work we should have some fantastic data from what will be the first landings on a small body in the Solar System."

Many glitches could arise. The DAS landers will be powered by solar panels. If one of these landers ends up landing in the bottom of one of the many craters that pock the Phobos surface it could find itself covered by permanent shadows from the crater rim. The initial power would fade quickly and the solar panels could not recharge the system. So, all data transmission would shut down. Even if a DAS lander happens to land on high ground in full sunlight, it could be oriented in such a way that the data transmission antenna, aimed towards Earth, would cast a shadow across the solar panel, again shutting off all power. Finally, if the lander finds itself on the side of a hill, the angle of its solar panel to the sun could be so poor that although power might not be cut off, it would be reduced considerably.

The experiments in this mission sound like something from science fiction. They sport such acronyms as LIMA-D, GRUNT, DION, FREGAT and KRFM-ISM-THERMOSCAN. One of the experiments is of special interest to Chicagoans. It is a device called an *alpha-backscatter spectrometer* that makes chemical measurements on the surface. It was originally developed by Prof. Anthony Turkevich, of the University of Chicago's Department of Chemistry. It is designed to function best in high vacuum, and this condition is met on the surfaces of both our moon and Phobos. It was carried on many of the early unmanned Surveyor missions that landed on our moon in the middle 1960s. It provided such good analyses of our moon's surface that it was possible to predict some of the rock types that we could expect to find when the Apollo missions finally went to the moon to collect samples.

It will be fascinating if even a part of all this comes off without too many hitches. Already there has been one major failure. Due to an error by a Soviet ground controller, one of the two spacecraft on the mission was accidentally destroyed last September on its way to Mars. There is, however, still the other spacecraft with its landers and instruments.

All of us in space research hope that the god Mars will take kindly to this latest incursion into his piece of space and not turn Deimos and Phobos against us puny Earthlings as he did so long ago. **FM**

Three juvenile males rejecting another

BABYSITTING and DAYCARE among the BARBARY MACAQUES

by Meredith F. Small
photos by the author

SCREECH! SCREECH! SCREECH! After many years of observing monkeys I knew this was the cry of a young macaque in trouble. Experience also told me that the infant would soon be rescued from peril by its ever-vigilant mother. Sure enough, as I stood staring up at the infant caught in the oak canopy, an animal galloped to the baby's aid. The adult shinnied up the tree, flipped the wailing infant onto its back, and scampered to the ground. Resting at the bottom of the tree, the older monkey cuddled the baby and chattered softly to it. In a matter of minutes the infant went from nervous shriek to placid calm.

It was my first day of watching this colony of Barbary macaques and I needed my binoculars for a closer look at the mother to note her identity. As the pair came into focus, I realized that the scenario was not what I expected. The teeth-chattering adult was a male, and it seemed that the mother was nowhere in sight. I was witnessing day-care in the forest, where males, females other than the mother, and even little juvenile monkeys are responsible babysitters.

Research has shown that primates, including humans, have a fascination with infants. This infatuation is usually restrained by mothers, who keep infants close to the belly until the infants are more independent and can escape unwanted attention. Among some primates, such as Indian langurs, this attraction to infants gets out of hand; infants are passed rapidly among adult females from the first day of birth. "Aunt"-infant interactions are usually explained as necessary to trigger and refine mothering techniques. Barbary macaques are of special interest because, as I discovered, infants are the focus for just about every member of the troop, not just females who might gain mothering skills.

Barbary infants, unlike other species of macaque, grow up in a "community atmosphere," where they are quickly assimilated into the social network of monkey life. Tossed around like footballs and played with like new stuffed toys, these infants are the social glue that connects adult relationships.

Macaques are evolutionarily successful; they have adapted to tropical forests in Southeast Asia, arid regions in India and Nepal, and snowy mountains of Japan. They are the most widespread primate genus other than humans, probably because they have an omnivorous diet; they eat just about anything. Barbary macaques, the subject of my investigation, are native

Meredith F. Small teaches anthropology at Cornell University, where her research focuses on primate behavior.

to the high mountains of Morocco and Algeria and are the famous "Barbary apes" of the rock of Gibralter.

The group I studied in La Forêt des Singes ("Monkey Forest"), in southwestern France, is a visitor park where humans see and learn about macaques under monkey rules. With 23 acres as a home range, and visitors restricted to a small path, these captive monkeys decide how much interaction they want with their human cousins. The familiarity between humans and monkeys also means that animal behaviorists, like myself, can make close observation of the animals without disturbing their normal behavior.

I spent a year watching the adult females of this provisioned group through the breeding season in the fall of 1986 and the birth season in the spring of 1987. Eleven of my fourteen focal females gave birth that year, and these females and their infants were my windows to understanding the pivotal role that infants play in Barbary macaque community life.

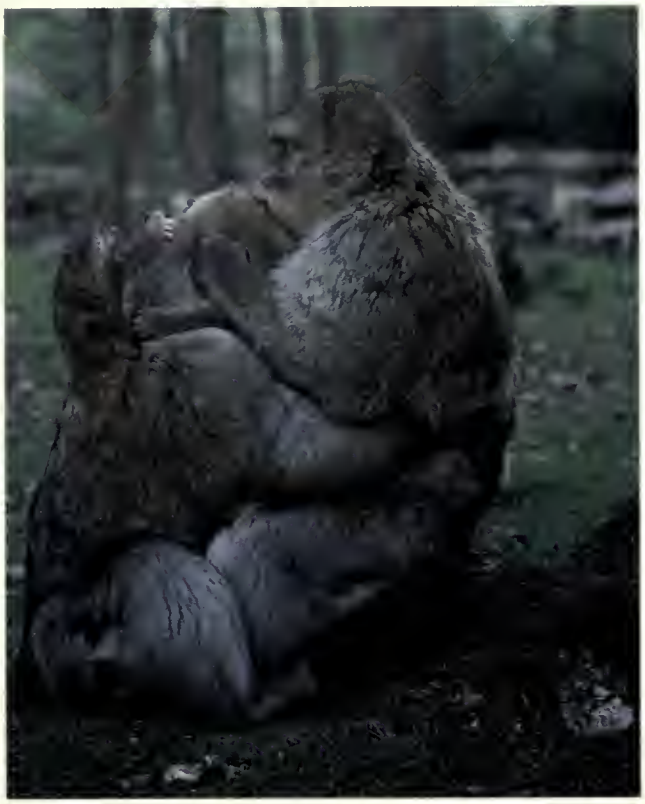
The birth season began on March 31. I walked through the morning fog toward my focal female of the hour, who was busily eating grass on the open meadow. She was surrounded by about ten other individuals. There was agitation in the air. As I grew closer to the group, I heard a kitten-like squeak on my right and looked down at the first Barbary infant of 1987, with its wrinkled pink face, large floppy ears, and contrasting black fur. He was promptly christened "Philippe" after one of my co-workers. His squeaks and wails were

Male with 6-month old infant

accompanied by a wobbly infant dance, an attempt to reach his mother's nipple. Thea, his mother, eventually moved him into position and he began to suck vigorously on her nipple. Next to Thea was her two-year-old juvenile daughter, who stared at the infant as if it had just landed from outer space, and another older daughter, Becky, who guardedly watched the other animals as they fixed on the new infant.

Twenty-four other infants were born that spring, including a set of dizygotic (fraternal) twins, Harold and Maude, the offspring of the highest ranking female. In all, there were exactly twelve female and twelve male infants. During the next three months I

Two males use infant in triadic interaction



Males use 6-month-old infant in triadic interaction.

watched the infants develop from helpless babies to semi-independent toddlers. What was more fascinating was how troop-mates used these kids as commodities in complex monkey social games.

Research in Morocco in the 1970s by John Deag and David Taub and more recently by Jutta Kuester and Andreas Paul on another captive group in Germany, tells us that Barbary macaque males are unusual in their treatment of infants. Primate males usually interact with infants only in monogamous systems. This makes evolutionary sense because monogamous males invest in infants who carry some of their genetic material. But Barbary macaque males cannot be assured of paternity. During breeding season, females in estrus mate two times an hour on the average. More importantly, however, Barbary females move from partner to partner, mating with almost every male in the troop. Because of this "promiscuous" behavior, males can never be sure which infants are his—it could be all or none. Even though true paternity is confused, Barbary males spend much of their social time with particular infants.

Male-infant interactions come in many forms. For example, males use infants in their own hierarchical tiffs. A lower-ranking male might grab an infant and carry it to a higher ranking male, engaging him in a ritual greeting. The forest is often filled with the grunts of males fawning over infants, or the sharp crack of their large canines as their teeth click together during a teeth-chatter greeting. Males use kids as "passports" to gain access to unapproachable partners, essentially to cement alliances with other males. The infant acts as a bumper against any possible protest by the other male. Although very young infants caught in these triadic interactions sometimes scream, and mothers sometimes protest, the infants are helpless pawns in the male-male friendship game.

Males apparently use infants for their own gain. But it's more difficult to explain why mothers let it happen.

It seems that mothers have little to fear from these would-be uncles; males are usually caring and affectionate toward their pint-size friends. In fact, most males have special friendships with particular infants. For example, half of the infants of my females were seen in the care of males. And some males spent time with as many as three different infants. Early in the birth season I saw three males sitting in a circle placidly munching grass. Like human fathers with front-packs, each had a tiny black infant attached to his belly and a protective arm curled around the baby.

Males are also highly responsive to infants in trouble. One of the twins, Harold, was once kidnapped by a juvenile female. He struggled in her arms and finally wrestled free. His mother was near at hand, but in his distress he ran to an adult male friend, Dionysus, who enfolded him and made monkey-soothing noises.

As infants get older they initiate these interactions, and males seem to be safe partners and friends. One day I was calmly recording the behavior of a mother-infant pair. A high-ranking male, Mercuir, swaggered passed me, an infant riding on his back. As Mercuir passed my subjects, he dipped his shoulder in invitation to the infant I was observing, who promptly hopped aboard for a ride. Mercuir then drifted by another mother-infant pair and collected a third infant. I watched in astonishment as the broad back swayed through the forest with three tiny pink rumps hunkered down on top.

There are probably long-term consequences of male-infant behavior. Since there is little male emigration, even in the wild, alliances formed between youngsters and adults may last until adulthood. Males may recruit infants as future colleagues by interacting with them as babies; it's as if babies were asked to join a club with a lifetime membership.

My research also revealed that males were not the

only ones interested in the new troop-mates; adult females were also intrigued by these live-action pink and black squeaky toys.

Philippe was only four days old when he was "kidnapped" by adult female "E73." At various times over the next three months, six different females grabbed him from his mother and carried him around for hours at a time. One female, La Petite Belle, just couldn't get enough of him. On fifty-six occasions she was spotted with Philippe in her arms or on her back. Thirty-five adult females out of the total forty-six were seen carrying infants that were not theirs. Even mothers, who presumably had their hands full, often went babysitting when their own kid was with someone else.

Stealing infants from their mothers wasn't the only way females and infants interacted. Females also spent much of their day walking up to mothers, cocking their heads toward infants, and greeting the infant with a teeth-chatter. These baby-greets might last for a few seconds or evolve into five minutes of buzzing confusion between the mother, the greeter, and the infant. The mother and the visitor would grin and clack their teeth together and nuzzle the infant. Sometimes the nonmother threw her arm around the mother and patted her. This may be the Barbary macaque version of a baby shower, only lacking the stuffed teddy-bear gift.

Females often seemed mesmerized by the infants of their friends. A female often moved quietly toward an infant, peeked around its mother and took a surreptitious look. She might then attempt a touch or grab, or try to coax the infant away. Mothers didn't usually protest much, and this makes sense. In the analysis of my data, I determined that female babysitters were usually well known to mothers and often shared the same rank. Mothers need not fear these females because they have a long-standing relationship. In fact, aggressive acts toward infants were rare. But why would females, especially those with their own infants, want to lavish all that time and attention on other babies? Just as in male-male-infant triads, infant-sharing among females probably helps maintain friendships. Infant greeting and babysitting not only allows mothers and "aunts" time together, it also establishes new connections between infants and "aunts."

Unlike adults, juvenile animals were often foiled in their attempts to shanghai infants. These adolescent monkeys usually staggered away, dragging an uncooperative infant almost as big as themselves. Sometimes young animals would rise up on their back legs and try to steal an infant, furtively looking behind as they clutched the baby to their chest, and stumbling bipedally through the grass. Although young Barbary females, and sometime males, were fascinated by infants, they didn't get much chance to hone their skills; babies were too often with adult males or females. Juveniles were most successful when the infant was a new brother or sister. If they hung around their mother long enough, chances were they would get an entrée to the infant. The two-year-old sister of Philippe spent most of the spring following him around. Whenever he spent time with a troop-mate, the older sister was right at his side.

Most of us humans can empathize with the Barbary macaque fascination for infants. When a human baby accompanies its parents to a gathering, the whole room starts to revolve around that baby. We are attracted to this miniature version of our own species, and perhaps it's the same for Barbary macaques. But there must also be important evolutionary reasons why this species spends so much time riveted on infants.

The key to understanding Barbary baby obsession is the complex nature of their social interactions. Primates, especially monkeys, apes, and humans, are adept social tacticians. Some scientists even believe that our large human brains evolved to keep track of social relationships. To operate as a primate in a large group, one needs to remember who is related to whom, who is an enemy and who is a friend. More importantly, those who form strong alliances often win in the game of reproductive success; they produce more offspring and pass more genes onto the next generation.

Juvenile female tries to take one of the twins from the alpha female.

Nonmother grooms mother to gain access to infant

In one sense, Barbary macaques are much like humans. Each animal knows the identities of monkeys with power, and they also have some idea of kinship and friendship. They form social networks that rival the most complex political organizations, and they act on those alliances. Males join together to oust another male from the top position of power, or related females band together to keep other females from getting the best food. Thus, friendships, especially well established ones, have profound evolutionary consequences.

Like campaigning politicians, adult male and female macaques enlist infants in their personal causes. In return, these responsible adults form a day-care system for infants that allows mothers time to get on with other things. Infants benefit most of all—they quickly learn the maze of social relationships that will mold their lives. And as an added attraction, they get to fly through the forest astride big furrry males, watching the frantic hubbub of their monkey-world from a safe position. **FM**

Mother (left) joins nonmother in baby greet.

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M/S Society Explorer
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FIELD MUSEUM TOURS

ISLANDS of the Flores Sea and Torajaland

An adventure cruise to Bali, Lombok, Torajaland, Kabaena, Flores, Komodo, Satonda, and Labuan Haji Reef

(with optional Yogyakarta and Borobudur extension)

Free round-trip international air fare for reservations received by January 31.
Departing August 30, 1989
15 days
Leader: Dr. Harold Voris

Aug. 30: Depart Chicago O'Hare to Los Angeles. Evening departure to Denpasar.

Aug. 31: Cross International Date Line.

Sept. 1: Bali. Morning arrival in Denpasar. Transfer to hotel on the "island of a thousand temples." Day at leisure visiting this mystical island.

Sept. 2: Bali. Day at leisure exploring Bali, perhaps journeying to mountain villages where age-old traditions still flourish. Handicrafts may be found in Mas, the woodcarving center, or Ubud, the village known for traditional Balinese paintings. Feast tonight on Balinese specialties and delight in a festive dance performance.

Sept. 3: Bali/*Society Explorer.* Spend the morning exploring on your own, perhaps surveying Balinese art from prehistoric times to the 20th century in the Bali Museum. This afternoon, board the *Society Explorer* and enjoy a fiery Indonesian sunset as we cruise past local villages.

Sept. 4: Lombok Island. Traveling overland, experience the contrast of this island—where lush rice fields border arid plains and sparkling mosques dominate rural villages. With Bali to the east, Lombok's history and culture are intimately tied to her neighbor. The deep strait between Bali and Lombok marks "Wallace's Line," named after naturalist Sir Alfred Wallace. Witness, as Wallace did, the differences that exist between islands east and west of the line. This evening enjoy the captain's Welcome Dinner.

Sept. 5: Cruising the Flores Sea.

Sept. 6, 7: Palopo/Torajaland. Disembark the ship in Palopo and travel through steep, rice-terraced slopes and rugged mountain peaks to isolated Torajaland. The Torajas, who believe they are descended from the stars, have a unique culture based on animistic beliefs and are perhaps best known for their colorful funeral ceremonies. One of the most striking features of the Toraja landscape is their unique architecture. The sweeping gables of their thatched-roofed homes rise at both ends like the bow and stern of a boat. Their ritual chants compare these homes to the ships that carried their ancestors here. On our excursion, we travel by land rover or small bus and overnight in best accommodations available.

Sept. 8: Kabaena Island. Expedition stop today. Sally out in Zodiacs to fish in Kabaena's rich waters and explore its seldom-visited village. Beautiful beaches and coral reefs provide excellent snorkeling and diving opportunities.

Sept. 9: Larantuka, Flores Island. With cameras ready, be sure to scramble topside as we cruise through the picturesque Larantuka Narrows enroute to Flores. Flanked by rolling tropical forests, Flores's spine is a ridge of rugged mountains that is punctuated by steaming volcanoes. Upon arrival, we're greeted by the village chief and his tribe who request that we join in their sacred ceremony and traditional dancing. After a tour of the village, enjoy hearing the Florenese sing in complicated four-part harmonies found nowhere else in the world.

Banda dancer, Indonesia
© Tobias Schneebaum/Society Expeditions Cruises

Sept. 10: Komodo Island. Called the "Island of the Dragons," Komodo is the natural habitat of the sole survivor of the dinosaur. Reaching ten feet in length and 300 pounds, the Komodo "dragon" has a life expectancy of 150 years. Its yellow-orange forked tongue, jagged teeth, and fearsome jaws give it an almost mythical appearance and many believe that a similar creature was the model for the Chinese dragon. Upon arrival, we are met by National Park rangers who guide us to prime observation point to see these unusual creatures feed. We also hope to spot masked cuckoo shrikes, spangled drongos, and cockatoos in the forest. Excellent snorkeling and diving may be available over a nearby coral reef as well as swimming from the beautiful beach.

Sept. 11: Satonda Islands/Labuan Haji Reef. Visit Satonda, a tiny island located off Sumbawa's northeast coast. Walk the beautiful shell-strewn beaches, visit with the local people, or dive in the rich waters. This afternoon we'll make an expedition stop at Labuan Haji Reef. Tonight, the captain hosts a Farewell Dinner.

Sept. 12: Disembark the ship and spend time in the colorful fruit and vegetable markets of Denpasar. Spend the rest of the afternoon exploring the town at leisure. Overnight in our deluxe hotel.

Sept. 13: Bali/Los Angeles. Afternoon departure from Denpasar, arriving in Los Angeles the same evening. (We have regained the lost day by crossing back over the International Date Line). Optional overnight in Los Angeles with morning return to Chicago September 14.

You may also choose to continue to the Yogyakarta/Borobudur extension:

Sept. 13: Yogyakarta. Transfer to hotel. Explore the art and batik galleries, or simply enjoy the sights and delicious smells of this ancient city, known as the cultural center of Java.

Sept. 14: Borobudur. Take an unforgettable visit to one of the greatest wonders of the world—the mighty Borobudur temple. Believed to have taken 10,000 workers 10 years to build, it rises 10 terraces, each smaller than the one below it. In the afternoon view the Sultan's Royal Palace. Completed in 1757, it is treasured as an archetype of classical Javanese architecture. Return to hotel for dinner and cultural show.

Sept. 15: Bali/Los Angeles. Return to Bali for departure transfer. Optional over-night in Los Angeles, returning to Chicago the morning of September 16.

PRICES FOR BASIC TOUR
Explorer Deck: $3,141-$3,465
Yacht Deck: $4,005-$4,311
Boat Deck: $4,995
Suite: $5,895

The above rates are valid through January 31, 1989, as you receive free international air transportation. As of February 1 the cost is increased by $800.00 per person.

Rates are per person, double occupancy. Air transportation from Chicago to Los Angeles is not included. A tax-deductible contribution of $200. to Field Museum of Natural History is included.

Price for Optional Tour: $290.00 per person; double: $350.00 per person, single. (Includes air transportation, hotel, meals, transfers and sightseeing tours.)

English Homes and Garden Tour

July 4-15, 1989
Leader: Dr. Bertram Woodland
Please call for information

We still have a few spaces on:

The Galapagos Islands Tour

March 3-14, 1989
$3,550-$3,840
Optional extension to Peru
March 14-20—$1,450
Leaders:
Dr. David W. Willard/Dr. Charles Stanish

Kenya/Tanzania Safari

March 3-24, 1989
$6,350.00
Leader: Audrey Faden

For reservations, call or write Dorothy Roder (322-8862), Tours Manager, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Il 60605

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FIELD MUSEUM OF NATURAL HISTORY BULLETIN

February 1989

Field Museum of Natural History Bulletin

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View of temporary exhibit "Traditional Crafts of Saudi Arabia," in Gallery 9 through March 12. See pages 4-6.
Photo by Ron Testa and June Bartlett.

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EVENTS

Performance

Exltacão À Bahia
Brazilian Dance Troupe
Saturday, Feb. 25
1:00pm and 3:30pm
James Simpson Theatre

The beauty of African culture, its spirit and joy, is the essence of the Brazilian musical and theatrical troupe "Exltacão À Bahia." Their unique Afro-Brazilian heritage is presented in a riot of color, rhythm, music, and dance.

"Exltacão À Bahia" is dedicated to the authentic and artistic presentation of the culture of Bahia, the center of the Afro-Brazilian people of Brazil. The culture manifests itself in the religious ceremonies brought to Bahia by African slaves, its noted Afro-Brazilian cuisine, and the rhythms of samba, frevo, and other joyous dances.

Formed in 1973, "Exltacão À Bahia" has performed extensively in Brazil and around the world. Their colorful repertoire includes "maculelê" (a folkdance performed with batons), "galanteio" (the women's flirtation dance), and "puxada" (a representation of the rhythmic pulling of nets by coastal fishermen).

Share the magic of brilliant costumes, powerful rhythms, lithe dancers, and the cultural tradition of a people faithfully kept alive by "Exltacão À Bahia."

Tickets: $8 ($6 members) $4 Children 12 and under.

Special note: Be sure to indicate time of performance requested on registration form. To register, use the coupon provided here.

Field Museum presents this performance in cooperation with Urban Gateways. The project is partially supported by a CityArts grant from the Chicago Office of Fine Arts, Department of Cultural Affairs, Varig Airlines, Inter-Net, and Hyatt Hotels Corporation.

Adult Courses

Continue to learn more about the world around you by enrolling in Field Museum's adult programs. Evening courses and weekend workshops begin again in February. Ancient cultures are considered in "The Incas and Their Ancestors," "Egypt: The Late New Kingdom," "Drawing Ancient Egypt," and "Four Corners Archaeology." Explore the natural world in "Owls of North America," "Predator or Prey," and "Conservation, Zoos, and People: The Latin American Effort." Sharpen language skills while learning about a new culture in "Conversational Spanish" and "Intermediate Conversational Japanese." Mexican embroidery, Chinese brushstroke, and tie-dye are among weekend workshop highlights. Consult the January/February/March Adult, Children, and Family Program Brochure for details. For further information please call (312) 322-8854.

The City Musick Performs February 17

The City Musick presents the second program in its acclaimed Mozart Series on Friday, Feb. 17, at 8:00pm. Works include Mozart's overture to "La Clemenza di Tito," Symphony No. 40 in G Minor, K. 550, and the Concerto in E-flat K. 495, featuring Gail Williams, natural horn. The program will be presented in Field Museum's James Simpson Theatre. Ticket prices are $20.00 and $16.00, with a 10% discount for Field Museum members. Call City Musick at 642-1766.

Registration

Be sure to complete all requested information on this registration application. Registrations are confirmed by mail. For registrations received less than two weeks before the performance date, confirmations are held at the West Door one hour before the performance begins. Phone registrations are accepted using Visa/MasterCard/Amx/Discover. Please call (312) 322-8854 to register. For further registration information, consult the January/February/March Adult, Children, and Family Program Brochure.

Return complete registration with a self-addressed stamped envelope to:

Field Museum of Natural History
Department of Education, Program Registration
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605-2497

Name _____

Address _____

City _____ State _____ Zip _____

Telephone: Daytime _____ Evening _____

Program Number	Program	#Member	#Nonmember	Total Amount
PP89101	Exltacão À Bahia 1:00pm			
PP89102	Exltacão À Bahia Child's Ticket 1:00pm			
PP89103	Exltacão À Bahia 3:30pm			
PP89104	Exltacão À Bahia Child's Ticket 3:30pm			
			total	

☐ Scholarship requested

☐ AMX ☐ Visa ☐ MasterCard ☐ Discover (Check one)

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Traditional Crafts of Saudi Arabia

Through March 12

An authentic goat-haired tent that once sheltered a family of nomadic people in the desert of Saudi Arabia, stands as the centerpiece of this special new exhibit on view in Gallery 9. The exhibition highlights the personal collections of John Topham, an American engineer who worked and lived in

Saudi Arabia during the 1970s. This unique collection of textiles, clothing, jewelry, weapons, and household utensils, represents the first comprehensive display of Saudi Arabian crafts to be seen in Chicago. The exhibit captures the beautiful achievements of a vanishing culture and reflects the artistic tradition of Saudi Arabia where artifact and artwork are one.

Before oil drilling became predominant in the 1940s, Saudi Arabia had little organized industry. The country was populated by small village communities and the Bedouins, a

nomadic desert people. These two groups depended upon one another through trade of their traditional crafts. With the introduction of the oil industry and modern technology, handcrafted products are being replaced by mass-produced items of plastic and aluminum. The tradition of brightly colored, elaborately patterned objects that have offset the austerity of the desert for generations is vanishing.

Topham's collection includes a rare and educational look at many of the "lost" crafts of Saudi Arabia. A large desert tent woven from goat hair greets visitors as they enter the exhibit. The tent is partitioned into three sections by woven panels, replicating the manner in which it would have been set up in the Saudi Arabian desert. Sections include the men's area, a center sleeping area, and the utility area. While a typical Bedouin tent would be sparsely equipped because of the transient lifestyle of its inhabitants, this tent serves as a showcase for many of the collection pieces.

The strength of Topham's collections lies in beautiful textiles; weaving remains the country's dominant craft. Arab weavers utilize a horizontal loom that holds the yarn parallel to the ground. Woven rugs, blankets, and tents incorporate geometric design patterns with tassel ornamentation. Human and animal figures are rarely depicted. Traditional colors in woven goods include red, black, white, camel, green, blue, and orange. The similarity between modern and traditional weaving is obscured by the brilliant, synthetic colors of factory-made yarns.

Apparel has always varied from region to region in Saudi Arabia, yet certain features like the loose fit that allows air to circulate is common to all. Costumes on display include a variety of women's floor-length dresses with long, wing-shaped sleeves. Women often tie these sleeves behind their neck to keep them out of the way while working. Dresses are often decorated with appliqué and embroidered with metallic cotton, silk, or rayon thread. Women are expected to cover their faces with black gauze veils and wear hoods over their head while in public domain. Men's dress is similar to women's, comprised chiefly of ankle-length shirts and a headcloth called a *ghutrah*.

Arab women are likely to wear jewelry at all times. Jewelry plays an important role in courtship rituals and constitutes a large portion of a bride's dowry. Necklaces, belts, bracelets, and earrings were traditionally made of gold and silver combined with turquoise, coral, agate, and glass. Today costume jewelry has almost completely replaced work in silver and gold.

Other pieces in the exhibit include riding accoutrements displayed on a six-foot-tall wooden camel. Camel bags were among Arab men's most richly adorned possessions, woven from brightly dyed wool and often decorated with tiers of sashes, ribbons, and tassels. Traditional weapons, coffee utensils, incense burners, and household crafts are also displayed.

Photos of Saudi Arabian art by Ron Testa and June Bartlett

12th Annual
Spring Systematics Symposium
"History and Evolution"

Saturday, May 13

Speakers

Garland E. Allen
Robert Boyd
Michael J. Donoghue
Marc Ereshefsky
Douglas J. Futuyma
Stephen Jay Gould
David L. Hull
David B. Kitts
Rachel Laudan
William B. Provine
Robert J. Richards
Michael Ruse
Lawrence B. Slobodkin

Moderator: John Flynn

Organizer: Matthew H. Nitecki

Registration

Kristine L. Bradof, Symposium Coordinator
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Field Museum of Natural History

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8 Photo by Diane Alexander White, 110685C

USHABTIS:

Tomb Figurines Of Ancient Egypt

by Frank J. Yurco

In ancient Egypt, the ushabti developed as part of the Osiride funerary practice. None are known from before the Middle Kingdom Period (2134-1786 B.C.). But in that period, they began to be manufactured. They may have been derived from small representations of the deceased in mummiform wrappings, but not long afterward a different association was made for them.

In the New Kingdom Period (1570-1080 B.C.) the ushabtis came to be inscribed with a text drawn from *The Book of the Dead*, called the ushabti spell, no. 151: "The deceased NN says: 'Hail ushabti figure, if I be called upon, or if any work is allotted to me in the Afterlife, such as is done by people—namely sowing fields, filling irrigation channels, or bringing the sand of the west to the east, may you be present when I call unto you.' " The Egyptians' afterlife was patterned upon their actual life, and the ushabti was, in effect, a stand-in ready to do the unpleasant chores that the deceased might be called upon to perform. At the height of the New Kingdom Period, a typical tomb held some 400 ushabtis, one for each day of the year, plus 35 or so overseer ushabtis, distinguishable by their customs.

The ushabtis follow coffin fashions, but they are usually made of glazed frit, or faience, usually bluish-green, or greenish. Other colors are also found: whitish, reddish, depending on what was mixed into the glaze. In the examples shown here, the three smaller, blue figures belong to a prophet of Amun, named Hori. They resemble coffins of the XVIIIth-XXIst Dynasties. The taller, greenish ushabtis in the back row are of the XXVIth Dynasty and were made for an admiral named Heka-em-sa-ef. These four reflect coffin design of the period, with a distinct base under the feet and a back pillar to help them stand. Each of these seven figurines may be seen in "Inside Ancient Egypt." **FM**

Frank J. Yurco, consultant for "Inside Ancient Egypt," is a doctoral candidate in Egyptology in the Department of Near Eastern Languages and Civilizations of the University of Chicago.

The Ancient Egyptian Marketplace

by FRANK J. YURCO

In the Field Museum's recently opened exhibit "Inside Ancient Egypt," one of the most innovative and important sections is the marketplace setting. The marketplace is unique and important because it presents a cross section of daily life and society in ancient Egypt. It is the central element of the daily life area of the exhibit, together with the Nile marsh diorama. Because so much of many Egyptian exhibits focuses upon mummies and funerary customs, this presentation of daily life assumes even greater importance, and the marketplace is the key to it.

The marketplace is based upon a very interesting and rare relief, that of a complete marketplace, found in the tomb of two barbers and cosmeticians, Ny-ankh-Khnum and Khnum-hotep, at Saqqara in Egypt. The two tomb-owners, perhaps brothers, lived in the Vth

Mastaba of Ny-ankh-Khnum and Khnum-hotep at Saqqara, reconstructed. Dynasty V, ca. 2450 B.C.
© Margaret Sears

Pyramid of Pharaoh Unis, remains of temple and causeway at Saqqara. Dynasty V, 2400 B.C.
© Margaret Sears

Dynasty (about 2450 B.C.), and became the owners of a fine tomb because ultimately they became pharaoh's barbers and cosmeticians. The fine state of preservation of their tomb is one of those fortunate accidents of circumstance that periodically come along in archaeology. Later in Dynasty V, Pharaoh Unis (father of Unis-ankh whose tomb chapel and burial chamber are featured in this exhibit) decided to build his pyramid and complex just south of the great and imposing funerary complex of Pharaoh Djoser of Dynasty III. By Dynasty V, this area of Saqqara had already become crowded with private and royal tombs, among which was the tomb of Ny-ankh-Khnum and Khnum-hotep. Unis's pyramid complex entailed not only a pyramid, but also a pyramid temple, a long causeway leading past cultivated fields to a valley temple, frequently found located on a canal that gave access to the river. Unis's causeway crossed over a number of earlier tombs, including that of Ny-ankh-Khnum and Khnum-hotep, and these were appropriated by the pharaoh in what might be termed

Pyramid complex of Pharaoh Djoser (Dynasty III, ca. 2750 B.C.), southern end, with tombs of Unis complex (2400 B.C.), including Unis Ankh, at Saqqara.
© Margaret Sears

Replica painting by Inigo Manglano-Ovalle of marketplace scene from tomb of Ny-ankh-Khnum and Khnum-hotep at Saqqara, on view in "Inside

Photo by Ron Testa 111030

Ancient Egypt."

ancient eminent domain. The superstructures of these tombs were demolished and their blocks incorporated in the masonry of the causeway. In 1975, a joint German-Egyptian expedition was excavating and consolidating Unis's causeway. There they found the reused blocks from Ny-ankh-Khnum and Khnum-hotep's tomb chapel. These have since been reconstructed into a complete chapel. In 1977, Ahmed Moussa and Hartwig Altenmüller published a formal description of the tomb.[1]

This complex array of accidents resulted in a remarkable state of preservation in Ny-ankh-Khnum's and Khnum-hotep's tomb chapel. The rooms are complete and retain much of the color applied originally to its sculpted low relief; indeed, this well preserved color helped the Museum's effort to reproduce the color scheme in Unis-ankh's tomb. Among these wonderfully preserved reliefs is the marketplace scene. This represents a complete market, with a personal touch—the barbers and cosmeticians business set up nearby. From later literary texts and tomb paintings and reliefs, it is known that barbers and cosmeticians in business for themselves set up their practice beside markets. Markets were held on specific days of the ten-day[2] ancient Egyptian week in different towns and villages, and that's where the barbers and cosmeticians set themselves up, attending to all who came to them. Ny-ankh-Khnum and Khnum-hotep had become pharaoh's barbers and cosmeticians, but in their tomb they represented in the reliefs an earlier stage in their careers, when they operated a private practice at the local marketplace.

In the topmost register of the four registers forming the marketplace relief, the two tomb-owners showed their private practice. They perform their services for people from all levels of society, from the marsh workers and fishermen to the overseer of an estate seated imperiously on a mat and attended by his own retainer and scribe. The barbering and cosmetics procedures are described in short captions in hieroglyphs above each scene. The marsh worker at the far left is having his legs massaged (p.15, top). The next man to the right gets a hair cut. The next is having his pubic hair shaven off; he is a marsh worker so this procedure may have helped him keep clean. The next man gets a shave; behind the operating barber an apprentice barber prepares to hand over a fresh razor, while a standing man described as "teacher" instructs him. The teacher clearly is the master, perhaps either Ny-ankh-

Above: Relief of Armanti hounds and trained monkey from mastaba of Mereruka, Dynasty VI (ca. 2350 B.C.), at Saqqara.
Katherine Rosich

Right: Relief showing hunting on the desert with Armanti hounds from mastaba of Mereruka, Dynasty VI
Katherine Rosich

Khnum or Khnum-hotep in person. The next group to the right shows the overseer of the estate receiving a manicure, while his retainer and scribe wait on either side attentively (below). The final scene at the extreme right shows a scribe seated and receiving a pedicure. The whole register, from right to left (conventional reading direction for the Egyptians) presents a cross section of society, such as would be found at a functioning local marketplace. In the spirit of this cross section, in the replica painting of this relief scene, in the exhibit, the Museum has shown another dimension of Egyptian society—the many shades of skin color. In Old Kingdom scenes such variation was not customarily shown; it was a concept introduced in the New King-

dom Period when Egypt's empire brought Egyptians into contact with diverse peoples, Asiatic and African. Yet, even as it is today, the Egyptian population itself ranged from light-toned in the northern regions to dark-toned in the far southern region around Aswan. In between, there is a gradual darkening tone as you progress from the Mediterranean coast to Aswan. It is this variation that our marketplace replica is intended to convey.

The regular marketplace is displayed in the next three registers, which may be read from the top downward. Again, various segments of society are shown interacting. In the second register two policemen are represented, not with dogs, but with baboons, on leashes! The policemen are at either end of the register, in what is clearly a humorous arrangement, such as the Egyptians loved so dearly. At the right, the senior policeman holds a female baboon which has just caught a thief by an unmanned market stall. The thief is naked, and the baboon has bitten his leg (p. 16, lower left). The verbal exchange is indicated by the captions in hieroglyphs. "Catch, catch!" says the policeman. The thief exclaims: "You're the authority, get him (off me) onto the ground! I'll desist from doing wrong." At the left end, a junior policeman pulls on the leash holding a male baboon that is pilfering fruit from a market basket (p. 16, top left). The shop owner volubly protests: "Youngster, you may do as you like—but only until your boss is brought to you!" The humor of this scene transcends the centuries—the police protect, but they also transgress sometimes. The use of baboons here is not unique. Elsewhere in Old Kingdom Egyptian reliefs baboons may be seen performing chores or being led on leashes. The Egyptians no doubt appreciated the baboon's intelligence and aggressiveness, but more than one relief also conveys humor using baboons. The Egyptians used dogs as well, but mainly for hunting; in such scenes the hounds are the Armanti breed, still used in Egypt to this day as guard dogs; they are fast, with a greyhound-like body, and very ferocious.

The remaining scenes are devoted to transactions between customers and merchants. In the second regis-

ter, second scene from the left, a fisherman sells whole fish from a basket (opposite). A standing customer offers him a jar capped with a seal, contents unknown. He may have just removed it from the empty shopping sack tucked under his arm. The fisherman says: "Give your price for fish." That the merchant is a fisherman seems quite clear, as he wears around his neck a large "U" shaped object. The same object is worn by the

fishermen and marsh workers in the barbering scenes. In other more elaborately depicted examples, this object has a tie and is also seen on boats; it resembles closely the hieroglyph *s3*, "protection." Yet, it seems not to be an amulet, for it is too big. Rather, it may be a life preserver made of papyrus reed that would help the wearer float should he fall into the river or a canal. In the following scene to the right, a young woman holding a smaller girl by the hand presents a bowl to a merchant (p. 16, lower right). He says: "Give your price for very sweet sycamore figs." The young woman, though wearing no clothing, has an amulet around her neck. Interpretation varies on who she might be—a sub-adult female, perhaps a servant girl. The little girl she holds looks up at her, saying: "Would you like that (I) now go home?" Even this text has some uncertainty because in Old Egyptian grammar first person pronouns were not written.

Moving down to the third register, the first scene from the left shows a man selling bread and green onions (p. 17, top). He says: "See these bread loaves? Six thereof in the basket for two *hekat*-measures of *swt*-grain." The grain may be durum wheat. The customer says: "Give something from which I can drink this

(and) I'll be grateful." These snatches of conversation present some difficulty, for the bread and onion seller has no drinks. Perhaps the customer wants him to get a drink from the tavern shown in another scene. Clearly, after a snack of bread and onions a drink would be desirable. It should be noted that the round, flat, pita-style bread shown is, with green onions, still a popular snack for rural Egyptians. Beer likewise remains a nationally

favorite drink. The reference to two *hekat* of grain is of great interest. The *hekat* was the basic grain measure in ancient Egypt, equal to 4.57 U.S. dry quarts, or about a quarter of a bushel. As grain averaged 2-4 *deben* of copper for a two-bushel sack, the six loaves were costing about ¼ to ½ *deben* of copper. This is relatively more expensive than the grain price alone, the difference perhaps representing the miller's and baker's profits. In Egyptian grain measure, the sack (*khar*) contained sixteen *hekat*, and it was subdivided into double and quad-

ruple *hekat* measures. Two quadruple *hekat*, or half a sack, was about a peck in modern terms, and the double *hekat* was ¼ bushel in modern terms.

The next scene also is interesting from the economic standpoint. A customer with a shopping sack slung over his shoulder and clutching a rolled-up papyrus in his hand offers a metal vase, probably copper, to the merchant (above). The customer says: "A crafted item of a *deben*-worth." The *deben* was a unit of weight, but also used for metals. Such vessels in the context of ordinary society were usually copper, so a copper vessel is most likely at issue here. The merchant replies: "See, this is the equal of your *deben*," as he extends a similar vessel to that of the customer. Perhaps we are dealing with a metal vessel maker and a merchant buying from him. The *deben* was divided in 12 *shat* (10 *kité* later in the New Kingdom Period). A *deben* in modern measure is 90-91 grams. In usage for metals it was especially found with copper, silver, and gold, the metals that underpinned the Egyptian economy. The ratio of value between copper, silver, and gold fluctuated in different periods, based upon the general economic situation and their availability to the Egyptians. In the Old Kingdom, the Egyptians had the resources of their own eastern desert, with gold, silver, and various stones useful for building or decoration, and after the IVth Dynasty, limited access to the resources of Nubia, to the south of Egypt. Copper was in good supply, but gold and especially silver were relatively rare. Unfortunately, no ratio figures for the relative value of the metals survive. From the New Kingdom Period there is documentation that silver was in a 5:3 ratio with gold. This relatively high value of silver was caused by the vast quantities of gold that Egypt was exploiting in the Nubian and Sudanese desert mines. Silver, by contrast, was found in limited quantity with the gold, but mostly had to be imported. Metallurgical analysis of some silver vessels found in the ruins of the temple of Tod (south of Luxor-Thebes) has shown that the silver originated from the well known Laurium mines, near Athens, in Greece. In antiquity, Mycenae controlled this area, and there is a variety of evidence for trade between Mycenae and Egypt, if not directly, through northern Syrian intermediaries. Copper was mined locally in the eastern desert, in Sinai, or else was imported in quantity from Cyprus, the ancient world's principal copper source. In the New Kingdom period copper was in the ratio of 100:1 to silver, and 167:1 to gold. One common method of trade in Egypt was to evaluate the goods to be traded in terms of one of the three metals; inexpensive goods in copper, medium priced in silver, and only the most costly in gold. In the Ny-ankh-Khnum and Khnum-hotep market most of the trade was done by evaluating in copper.

The next scene shows a seal carver before a merchant offering fish cut open and cleaned (p. 18, top). The merchant remarks that he would be satisfied to hand over the rest of his basket of fish for the seal being carved. The seal cutter remarks: "I'm cutting the seal." The seal might well be worth the whole basket of fish

because seals were often cut out of semi-precious stones and were inscribed. Behind the fish vendor stands a balding man called a "copper craftsman"; he holds three fishing hooks and what may be a stamp seal. Perhaps he too meant to make an offer for the fish; his fishing hooks would certainly be useful for the fisherman. Beside both the seal cutter and the copper craftsman two bags stand upright on the ground. These may belong to each of the craftsmen respectively, although both also carry shopping sacks slung over their shoulders.

The rightmost scene shows a man seated before a female tavern keeper who dispenses a drink (below). She pours it through a strainer into a bowl; Egyptian barley beer was heavy in sediment and lees, and so required straining, so no doubt that is the drink being served. The customer says: "Fill it up; though I'm filled, the barley beer is of excellent quality." The customer also has a shopping sack slung over his shoulder, so the tavern is part of the marketplace, much as snackbars are found in modern shopping malls.

In the fourth register, at the left, a woman selling pottery cups says: "See, something you can drink from," as she hands over a pottery cup (p. 19, left). The customer offers her in return a fan, perhaps woven from reeds. This exchange could be a simpler sort of barter, where the goods are inexpensive and their relative values are well known. The woman might be a potter's wife. This calls to mind Herodotus's remark in describing 5th century B.C. Egypt, that the women ran the markets while the men stayed at home. In this marketplace, however, we see a mix of men and women as both merchants and customers. Still, this all reflects another aspect of ancient Egyptian society: women were equal legally and economically with men. They could run businesses, manage farms or estates, engage in commerce, and argue their own cases in law courts. Moreover, by force of pharaoh's law, they kept title to their property, even after marriage, and they were guaranteed a ⅓ share of all jointly acquired property in a marriage situation. The equality is attested in Old, Middle, and New Kingdom Period Egypt, and onward into the Late Period when the Greek authors commented upon it as a social policy that differed from most other cultures. Even in the Ptolemaic Period, Egyptian women argued their own cases in court, while the Greek settler women had to be represented by a *kurios*, a legal representative. Little wonder that some Greek women preferred to have their cases heard in Egyptian courts!

In the next scene, a heavily laden customer deals with a merchant selling bunches of grapes (p. 19, top). The merchant says: "Hand over this half-*hekat* container, (and) I will fill these into it." The customer remarks: "Stranger, should I give the half *hekat* con-

tainer of my ruler?" The question seems to be over the issue of a standard-sized container. The Egyptians were much concerned with this issue, for non-standard containers could be used to cheat. A "half-*hekat* measure of my ruler" might imply a container of a standard measure guaranteed by the government. In another set of documents from the XIth Dynasty farmer Heka-nakht, we learn that when Heka-nakht wished to have some debts collected from people in his local town, he cautioned his own people to be sure to take along his own hide-covered measuring container. Clearly, he didn't trust the containers of those who were in debt to him!

The next scene shows a customer without a shopping sack offering a vase, presumably with its contents, to a merchant selling vegetables (below, right). The merchant remarks: "Give your price, and I will give fine vegetables." In the basket, green onions, romaine

lettuce, and garlic are displayed. Again, this transaction may be a simple barter style with commodities whose values were well known.

The final marketing scene (p. 20) is perhaps the most interesting. It shows a cloth merchant's shop. A roll of linen cloth is unfurled; one of the shopkeepers stands holding the cloth up with his left hand while he extends his right arm, fingertip to elbow, along the cloth. The arm—fingertips to elbow—literally is the cubit, so the cloth is being measured. The text above him reads: "A cubit of cloth for six *shat*." His assistant stands holding up the cloth with both hands; he remarks: "I say, this is truly of divine (quality)!" The customer, a portly, balding man, seated on a cushioned seat concurs: "great quality," as he feels the cloth. The scene is of very great interest as it shows measurement

in length, by the cubit. The standard cubit in Egypt was 20.6 inches (523 millimeters), and was subdivided into seven palms and 28 digits. The cloth measurement hardly varies from the modern practice of measuring cloth by the yard. The reference to six *shat* likewise is of great interest. The *shat* unit, 12 *shat* to the *deben*, has already been mentioned, but it should be noted that this unit was used only in silver and gold weighing, not with copper. So, the cloth is selling most probably for six *shat* of silver per cubit. In a New Kingdom Period text, a skirt of fine linen and three loincloths of fine linen were valued at five *kité* of silver respectively. As 10 *kité* equalled one *deben*, the five *kité* are equal to six *shat* in earlier terms. As a skirt would require about two cubits of cloth, the Old Kingdom cloth is more expensive (assuming about the same value for silver). Still, in light of the remarks made by the shopkeeper and cus-

tomer about the cloth's quality, the high price is understandable. Certainly, in terms of the average worker's pay in grain at the village of Deir el-Medinah in the New Kingdom Period, this cloth was costly.[3] So it is not surprising to see that the buyer is a portly, balding man. In the Old Kingdom Period, a paunch indicated wealth and high status.

From the discussion it is clear that the marketplace of Ny-ankh-Khnum and Khnum-hotep is a unique relief and document. Other fragments of Old Kingdom market scenes are known, or else small selections of several scenes at most, but nowhere else do we find a full set of market scenes, complete with adjunct scenes such as this one. New Kingdom scenes are known, but they do not have the all-important bits of conversation that this market has. Further, while the practice of evaluating commodities in terms of copper, silver, and gold are well attested from the New Kingdom Period and even from the Middle Kingdom, this is the first evidence of such a system from the Old Kingdom Period. It shows that the Egyptians early in their history went beyond simple barter and adopted a system of evaluating commodities in terms of copper, silver, and gold to carry out transactions. These same metals have formed the basis for most economies, including our own until 1933. Only coinage and banking were lacking in the ancient Egyptian model. These appeared in Egypt after 405 B.C., when large companies of Greek mercenaries serving in Egypt demanded their pay in gold coins. Banking was developed in the Ptolemaic Period. Yet, the earlier Egyptians came as close to coinage as possible without calling it coinage. In the Heka-nakht archive of Dynasty XI (referred to above), Heka-nakht in one document mentions having sent 24 copper *debens* to his associates at Thebes for the renting of some land. From the writing, he can only mean 24 pieces of copper, each weighing a *deben*. This reference may be added to other evidence already cited by Jaroslav Černý, who likewise suggested that the Egyptians had come very close to actual coinage.[4]

Just how valuable the marketplace scene is for explaining the workings of the ancient Egyptian economy is evident not only from this discussion, but from the exhibit scenes it has led to. Grain measuring standards, weights, measures, evidence of copper, silver, and gold as metals underlying the economy, already in the Old Kingdom Period, are all very important evidence. Moreover, the different levels of society shown indicate that this is a village market, not the market of a large town or city. So, it shows that this economic system was known to, and used by a fairly wide societal base in ancient Egypt. For the exhibit "Inside Ancient Egypt," the marketplace is a crucial component in the layout of the daily life of the ancient Egyptians. Its discovery in 1975, publication in 1977, and utilization in this exhibit in 1988 form a fortunate set of circumstances. **FM**

1. Moussa, Ahmed, and Hartwig Altenmüller. *Das Grab des Nianchchnum und Chnumhotep.* Archäologische Veröffentlichungen 21. Deutsches Archäologisches Institut Abteilung Kairo. Mainz am Rhein: Verlag Philipp von Zabern, 1977, pp. 79-85; Tafel 24 and 27.

2. The ancient Egyptians had a 12-month calendar, with months of 30 days each; each month was divided into three weeks of 10 days each.

3. The average worker received at most about four sacks of grain, emmer wheat, per month, worth from one to four *deben* in copper per sack. But they also received supplements in payment, such as fish, firewood, and fresh vegetables, or oils. In the reign of Ramesses II (1279-1213 B.C.) 10 *deben* of copper equalled one *kité* of silver. Thus, the grain wages worth a total of 4 to 16 *deben* of copper equalled from ⅔ to 1 and ⅓ *kité* of silver, at best a third of the value of a shirt of fine linen, worth 5 *kité*. See further, Jaroslav Černý, "Prices and Wages in Egypt in the Ramesside Period," *Cahiers d'Histoire Mondiale.* Paris: Libraire de Meridiens, 1954, pp. 903-921.

4. See note 3, Černý, "Prices and Wages," 911-912.

Egyptian Bronzes on View in "Inside Ancient Egypt"

Left: Sistrum (percussion instrument), with image of Hathor, goddess of heaven and beauty, on handle, Late Period. *Center:* Jug on stand, inscribed "made by oarsman of His Majesty Pa-am; property of Amun," New Kingdom Period. *Right:* Mirror with papyrus-form handle and Hathor-head. New Kingdom Period.
Cats. 30318, 30177, 30324

Photo by Diane Alexander White

Pygmy hippopotamus skull from Akrotiri (FN 120).

TRACKING THE EXTINCT PYGMY HIPPOPOTAMUS OF CYPRUS

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photos by the author
except where noted

FOR THE PAST 300 YEARS, and even today, the extinct fossil mammals of the eastern Mediterranean island of Cyprus have been interpreted as being the bones of saints, early Christian martyrs, antediluvian beasts and dragons. Not until the early 1900s were these bones correctly identified as pygmy mammals — a pig-sized hippopotamus and a pony-sized elephant.

Cyprus is not unique in the Mediterranean in having such Disneyland-like animals, mainly of the later Pleistocene period (1,000,000-10,000 years ago). Sicily and Malta also had pygmy elephants and hippos and various giant species: dormice (squirrel-like rodents), swans, vultures, and tortoises; Malta also had pygmy deer. Crete had pygmy hippos and elephants, both pygmy and large deer, a giant "walking" owl, and large rodents and shrews. Other Greek islands had pygmy hippos, elephants, and deer as well as giant tortoises.

Corsica and Sardinia had pygmy deer, a "rat-like"

hare, giant otter, and large rodents and shrews; Sardinia also had pygmy elephants, dwarf pig, small antelope, and macaque monkeys. The Balearic Islands had a small, unique antelope-goat (sometimes called a "mouse-goat"), giant dormice, large shrews, and giant tortoises.

These animals were able to reach islands from the mainland either by swimming or on natural rafts. The reason for such migration is not clear, but it may have been due to overpopulation on the mainland and/or to decreased food sources. Such colonization would have been very rare, and, as a result, the new population would have been numerically small. Over time, the dwarf and giant forms evolved on these islands, derived from their normal-sized mainland ancestor. Even during the Pleistocene glaciations, when sea levels were lowest, Cyprus remained separated from the now submerged Gulf of Alexandretta, on the coast of Turkey, by about 20 miles.

In general, larger mammals become smaller, while rodents, tortoises, and some birds become larger. Dwarfism/gigantism is a common phenomenon on islands which lack large ground-living carnivores and which are far enough from the mainland not to receive continuing colonizers. The small size of these once-large mammals gave them greater mobility in mountainous island environments. It also enabled them to more efficiently utilize their food sources, thus permitting a larger population. Their smallness also made it easier for them to regulate their body temperatures (a proportionally larger body surface facilitates heat exchange).

The once-large mammals exhibit definite bone fusion (syndactyly) and bone shortening in their lower limbs; they also have relatively heavier built legs with stouter bones. The Cypriot hippo moved its limbs primarily in the fore-aft direction, sometimes called "low-gear" locomotion, but could not move them sideways. This suggests that, unlike its mainland ancestor, it was better adapted to walking than to swimming. The Cypriot and Cretan hippos have also lost their foot pads; they apparently walked on the tips of their toes. This would have allowed them greater mobility and agility in the mountainous environment. All dwarfed hippopotami have their eyes and nose on a lower plane than the modern African hippopotamus. These positions suggest that the dwarfed hippopotami are spending more time on dry land than in the water. The Cypriot hippopotamus also exhibits changes in the pattern of the skull bones, the number and shape of the teeth (lophodont, *i.e.*, with molars adapted for grinding) and wear pattern of the jaws. All this evidence suggests that the hippopotamus had a mode of life somewhat like a leaf-eating pig.

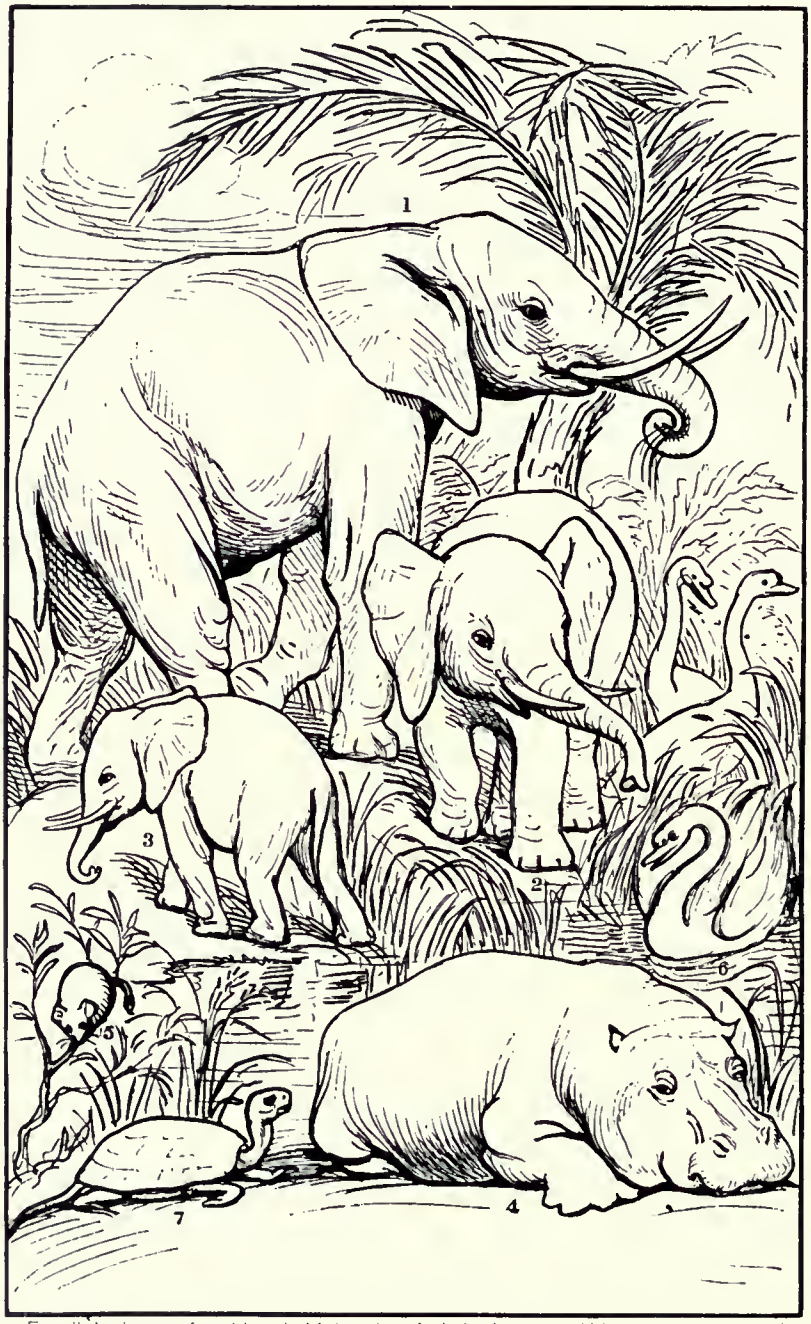
Both the dwarfed deer and antelope-goat have fused and shortened foot bones (metapodials and phalanges), which are also characteristic of "low-gear" locomotion. This suggests that movement was restricted to a mere amble instead of the quick speed found in their larger ancestors. With no predators to evade,

the loss of speed was not a significant handicap.

The small size of most rodents and insectivores allows them to hide from predators in small burrows. It is possible for these once-small animals to become larger when there are no ground-living carnivores to prey on them. Larger size would provide an additional protection from the (sometimes giant) birds of prey.

The Pleistocene-Early Holocene Fauna of Cyprus

An average adult African hippopotamus is 12-15 feet long, 3¾ feet tall and weighs about 4½ tons. The Cypriot pygmy hippopotamus, *Phanourios minutus*, currently known from 32 sites, would have been less than 5 feet long and 2½ feet tall. The modern African ele-



Fossil denizens of prehistoric Malta: dwarfed elephants and hippopotamus, giant swans, dormouse, and tortoise. From Andrew Leith Adams, *Notes of a Naturalist in the Nile Valley and Malta*, 1870, Edinburgh.

Cave chapel dedicated to St. Elias, north Cyprus. About 12 feet high at entrance. Bones found inside the cave are all pygmy hippopotamus.

phant is known to be the largest living land animal, with a shoulder height of 10-13 feet. The Cypriot pygmy elephant, *Elephas cypriotes,* known from 13 sites, would probably have stood only 3 or 4 feet tall.

Several sites have produced the remains of rodents and there is also a turn-of-the-century record of a few bones of a genet (a carnivore related to the civet and mongoose) from one of the sites that also produced hippopotamus and elephant remains. The genet is probably not contemporary with the pygmy forms, and its presence on the island cannot be easily explained.

Earlier, larger forms of hippopotamus have not yet been found on the island, but there are three additional sites on Cyprus which have produced a total of seven elephant teeth larger and probably older than those of *E. cypriotes.* These chance finds come from deep wells and gravel pits and belong to an animal intermediate in size between the mainland ancestor and the later Cypriot dwarfed form.

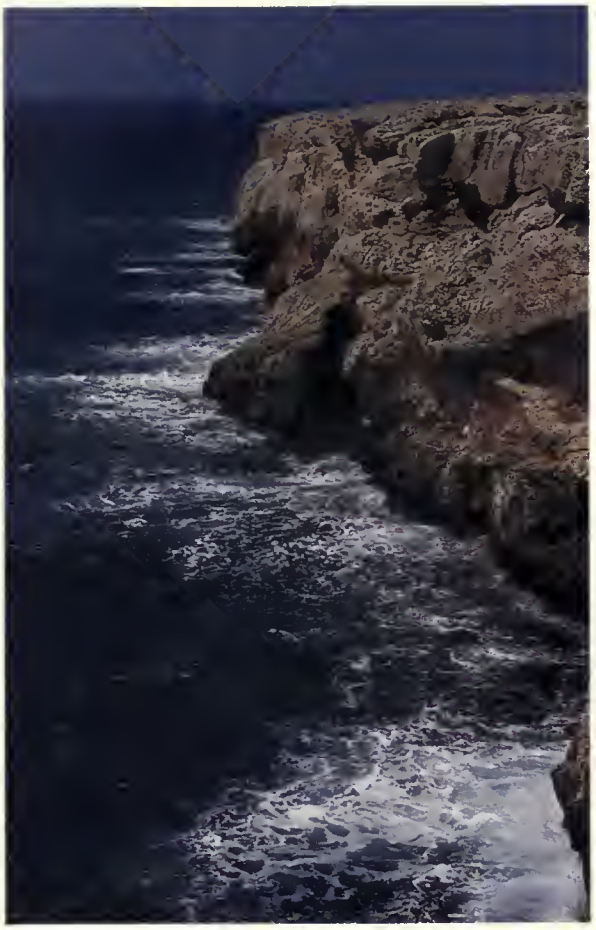
Only one of the Cypriot sites has an absolute date (see below), but scholars have assumed that many of the sites producing the pygmy mammals may be 100,000 or even 500,000 years old, based on their geologic situation. With the cooperation of Prof. Jeffrey L. Bada of the Scripps Institution of Oceanography in La Jolla, California, I have initiated a project to date some of these bones with a process known as amino acid racemization. Dr. Bada has already done similar dating work on the pygmy elephants of Sicily.

I first became interested in Mediterranean island dwarfed animals while doing paleontological and archaeological work as an undergraduate at Harvard University. In 1973 and 1974, under the sponsorship of Harvard's Museum of Comparative Zoology (MCZ), I examined previously known mammal sites, discovered new sites, and collected bones for the MCZ.

In the course of conducting this research in the early 1970s, I talked with many local people about these sites and bones and heard numerous interpretations of these remains. One story, known since 1860-70, told of bones found in caves at Cape Pyla in southern Cyprus as being the remains of saints or Early Christian martyrs. Pilgrimages were made to these caves and candles were burned there in honor of the sacred remains. Such pilgrimages continued into the early 1970s; all the bones are actually pygmy hippopotamus.

At a site in the southern foothills of the Kyrenia mountains in northern Cyprus, an eroded cave has been made into a small chapel by adding walls and a roof, and dedicated to St. Elias. When this hippopotamus site was first discovered in 1902 a native woman came to the chapel to light an altar lamp, believing that these were the saint's bones.

On the north coast, near the village of Ayios Yeoryios, a narrow rock ledge preserves large numbers of pygmy hippopotamus bones as well as two pygmy elephant teeth. These bones are believed to be the remains of St. Phanourios, a youth who heard the call of Christ and sailed to Cyprus from Turkey. According to tradition, he died while ascending the cliff at this spot; the rock-cut chapel and a more recent white-washed chapel are both dedicated to him. Until at least 1970



Cliffs at Cape Pyla, southern Cyprus, which yielded pygmy hippopotamus bones from five caves.

The pygmy hippopotamus bones at Ayios Yeoryios, Cyprus.

local villagers collected these bones, powdered them, and mixed them with water, believing the concoction to be a cure for nearly every disease known to man. In 1972 scholars decided to separate the dwarfed Cypriot hippopotamus from the genus *Hippopotamus*; appropriately, *Phanourios* was chosen as the new generic name.

Not all Cypriot fossil mammal remains are thought to be saints or martyrs. Near the village of Ayia Irini, in Cape Kormikiti in northwestern Cyprus, there is an extensive site called Dragontouvounari (Greek for "Hill of the Dragons"). This fossil mammal deposit was interpreted by the residents as being the burial place of dragons killed in a catastrophic flood.

Elsewhere on the island similar deposits of bones are virtually ignored. At a *mandra*, or sheep's fold, north of Ayia Irini, hippopotamus bones are found under a thin layer of dried goat dung, ignored by all except enterprising explorers.

Since the late 1970s my research has taken me away from pygmy mammals. I have mainly analyzed marine shells and animal bones from archaeological sites in the Mediterranean Basin and Near East. During the summer of 1988, however, I returned to Cyprus to continue research on the dwarfed mammals of the island, this time from a new site which also produced evidence for human interaction.

Excavations on Eagle's Cliff

In 1961, a 14-year-old English boy named David J. Nixon, spending six months with family or friends who were stationed at the Royal Air Force base at Akrotiri in southern Cyprus, came across an eroded rock-shelter on a precipitous cliff about 200 feet above the Mediterranean Sea. Here he found fossilized bones, some of them burnt, as well as marine shells and fragments of chipped stone tools.

Nixon took some of this material back to England, and in 1966 he showed them to an authority on fossils and prehistoric archaeology, the late Dr. Kenneth P. Oakley, of the British Museum (Natural History). Oakley identified the bones as belonging to the pygmy hippopotamus, the shells as the edible snail *Monodonta*, and the chipped stones as being possibly Neolithic.

In 1971, after reading a book on the archaeology of Cyprus by Dr. Vassos Karageorghis, director of the Department of Antiquities of Cyprus, Nixon wrote to Karageorghis about this site. The Nixon letter, maps, and photographs were received by the Cyprus Museum, but were never followed up by archaeologists on the island.

The sheep's fold made from an eroded cave called Liveras-*Mandres Virilas* produced pygmy hippopotamus bones below a thin layer of goat dung. Here the author examines the bones with a Maronite priest (in white) and young volunteer. Summer 1973.

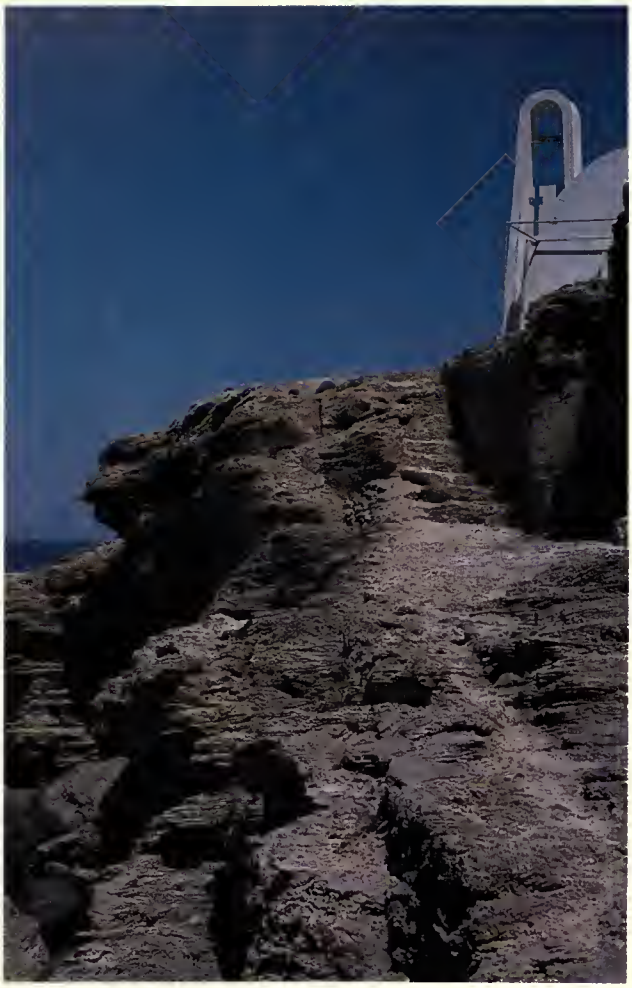
In 1980, a British officer named Lt. Brian Pile rediscovered the site when conducting an archaeological survey on the Akrotiri peninsula, and mentioned it to Dr. Stuart Swiny, director of the Cyprus American Archaeological Research Institute (CAARI), in Nicosia. Later that year they visited the site and collected additional bones, shells, and flints. The site is often referred to simply as Site E, Pile's name for it in his survey; more technically it is called Akrotiri-*Aetokremnos* (Greek for "Eagle's Cliff").

Since 1980 various scholars have visited the site and examined the small collection of bones, shells, and chipped stones housed in CAARI. Carbon-14 analyses performed on the 1980 bones were inconclusive—some dates were much earlier than man was previously thought to exist on the island while others indicated that the bones were less than 2,000 years old. This extreme range of dates seems attributable to the fact that the tests were made on contaminated surface material.

The site quickly became very controversial: was man indeed associated with animals previously thought to have become extinct 500,000 or 100,000 years ago, long before he arrived on the island? Did man play a role in the extinction of these animals and if so, when did man first arrive on the island? Conventional wisdom put earliest man on the island around 7000-6500 B.C. (calibrated carbon-14 dates). This period, the Aceramic Neolithic, is typified by circular or subcircular buildings, stone bowls and figurines, domesticated plants and animals, and burials below the house floors.

In 1987, ten days of surface collection and test trenching were performed at the Akrotiri site, producing more than 250 lbs. of bone, uncontaminated carbon-14 samples, and about 70 stone artifacts. This project was directed by Dr. Alan H. Simmons of the Desert Research Institute, University of Nevada System. I was asked to study the bones, but could not join the team on Cyprus in 1987 because of other commitments in Italy and Greece.

In the summer of 1988 I was able to analyze the 1987 bone collection through a Pacific Scientific Company Fellowship (administered by the American Schools of Oriental Research). For three weeks in September 1988 we also conducted more intensive excavations at the site, these funded by the National Geogra-



Site of Ayios Yeoryios, north Cyprus. Bones are found on rock ledge to left at bottom of stairs. To right of stairs is old rock-cut chapel and modern white-washed chapel at top.

phic Society. We had a larger staff this time, including experts in Cypriot prehistory, stone tools, geomorphology, and cave geology. Preliminary reports on the 1987 season have already been published and a report on the 1988 season is in press.*

So far we have excavated more than 1,200 lbs. of bone and shell from a limited excavation area. The bone is preponderantly of the pygmy hippopotamus, and I estimate that we have over 100-120 individual hippopotami present, of all ages from fetal to very aged. Also present are about 40 bones of the pygmy elephant, from at least three subadult individuals. There are also a large number of bird bones, some quite large in size and identified preliminarily as bustards. These are now under study by Dr. Cécile Mourer-Chauviré, a French expert in Pleistocene Mediterranean avian osteology. It will be interesting to see if they belong to a new "giant" species.

There is only one fish bone in the entire collection, identified by a fish-bone expert, Mark J. Rose, as probably coming from a grey mullet. Large numbers of edible marine shells, mainly *Monodonta*, but also the limpet *Patella*, were excavated. These shells are frequently burnt and crushed. Crabs and sea urchins were more rarely eaten by the prehistoric residents of Akrotiri. All these marine invertebrates could have been collected in shallow water on the rocky shore.

About 325 flints, mainly scrapers of various types, have been found. Finds also include a stone pendant and a stone bead, as well as ornamental shells, particularly the naturally-holed *Dentalium* and various holed small gastropods (*Columbella, Conus*).

So far we have obtained 15 carbon-14 dates, making Akrotiri the best dated prehistoric site on Cyprus. Discounting the early contaminated surface dates, the samples yield a weighted average of 8230 B.C. (uncalibrated). The earliest dates for the Aceramic Neolithic on the island are 5892 B.C. (uncalibrated), making Akrotiri more than 2,300 years older.

New intriguing finds from elsewhere on the island suggest that Akrotiri may not be the only site with evidence for possible pygmy mammal/man interaction. Several years ago a pygmy hippopotamus metacarpus (forelimb foot bone) fragment was found at the Aceramic Neolithic site of Cape Andreas-*Kastros* at the northeasternmost point of the island. Last summer, a fossil mammal shaft fragment with man-made modification was identified from a surface collection made

*Simmons 1988a, b; Simmons, Held and Reese 1989 (see Bibliography).

Helicopter view of the site of Aktrotiti-*Aetokremnos* in southern Cyprus. September 1988. Photo by Steve O Held

over 15 years ago at the contemporary north coast archaeological site of Akanthou-*Arkosyko*, not too far from two known fossil mammal sites. The question is whether the animals producing these two bones were contemporary with the archaeological site or were later picked up already fossilized by a Neolithic collector.

Recent reexamination of one of the caves at Cape Pyla may be more similar to the Akrotiri finds. Here in the summer of 1988 my colleagues and I found *Phanourios* bones, burnt bone fragments, *Monodonta* shells, charcoal, and some chipped stone pieces.

The discoveries at Akrotiri make it an exciting time for Cypriot archaeology. The ramifications of our work have major implications for early prehistoric archaeology well beyond Cyprus. Once we understand what is happening at Akrotiri we can use it as a model for trying to explain the extinction of the endemic faunas of other Mediterranean islands as well as the reasons and evidence for early human seafaring in the Mediterranean Basin. **FM**

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M/S Society Explorer
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ISLANDS of the Flores Sea and Torajaland

An adventure cruise to Bali, Lombok, Torajaland, Kabaena, Flores, Komodo, Satonda, and Labuan Haji Reef

(with optional Yogyakarta and Borobudur extension)

Departing August 30, 1989
15 days
Leader: Dr. Harold Voris

Aug. 30: Depart Chicago O'Hare to Los Angeles. Evening departure to Denpasar.

Aug. 31: Cross International Date Line.

Sept. 1: Bali. Morning arrival in Denpasar. Transfer to hotel on the "island of a thousand temples." Day at leisure visiting this mystical island.

Sept. 2: Bali. Day at leisure exploring Bali, perhaps journeying to mountain villages where age-old traditions still flourish. Handicrafts may be found in Mas, the woodcarving center, or Ubud, the village known for traditional Balinese paintings. Feast tonight on Balinese specialties and delight in a festive dance performance.

Sept. 3: Bali/*Society Explorer.* Spend the morning exploring on your own, perhaps surveying Balinese art from prehistoric times to the 20th century in the Bali Museum. This afternoon, board the *Society Explorer* and enjoy a fiery Indonesian sunset as we cruise past local villages.

Sept. 4: Lombok Island. Traveling overland, experience the contrast of this island—where lush rice fields border arid plains and sparkling mosques dominate rural villages. With Bali to the east, Lombok's history and culture are intimately tied to her neighbor. The deep strait between Bali and Lombok marks "Wallace's Line," named after naturalist Sir Alfred Wallace. Witness, as Wallace did, the differences that exist between islands east and west of the line. This evening enjoy the captain's Welcome Dinner.

Sept. 5: Cruising the Flores Sea.

Sept. 6, 7: Palopo/Torajaland. Disembark the ship in Palopo and travel through steep, rice-terraced slopes and rugged mountain peaks to isolated Torajaland. The Torajas, who believe they are descended from the stars, have a unique culture based on animistic beliefs and are perhaps best known for their colorful funeral ceremonies. One of the most striking features of the Toraja landscape is their unique architecture. The sweeping gables of their thatched-roofed homes rise at both ends like the bow and stern of a boat. Their ritual chants compare these homes to the ships that carried their ancestors here. On our excursion, we travel by land rover or small bus and overnight in best accommodations available.

Sept. 8: Kabaena Island. Expedition stop today. Sally out in Zodiacs to fish in Kabaena's rich waters and explore its seldom-visited village. Beautiful beaches and coral reefs provide excellent snorkeling and diving opportunities.

Sept. 9: Larantuka, Flores Island. With cameras ready, be sure to scramble topside as we cruise through the picturesque Larantuka Narrows enroute to Flores. Flanked by rolling tropical forests, Flores's spine is a ridge of rugged mountains that is punctuated by steaming volcanoes. Upon arrival, we're greeted by the village chief and his tribe who request that we join in their sacred ceremony and traditional dancing. After a tour of the village, enjoy hearing the Florenese sing in complicated four-part harmonies found nowhere else in the world.

Sept. 10: Komodo Island. Called the "Island of the Dragons," Komodo is the natural habitat of the sole survivor of the dinosaur. Reaching ten feet in length and 300 pounds, the Komodo "dragon" has a life expectancy of 150 years. Its yellow-orange forked tongue, jagged teeth, and fearsome jaws give it an almost mythical appearance and many believe that a similar creature was the model for the Chinese dragon. Upon arrival, we are met by National Park rangers who guide us to prime observation point to see these unusual creatures feed. We also hope to spot masked cuckoo shrikes, spangled drongos, and cockatoos in the forest. Excellent snorkeling and diving may be available over a nearby coral reef as well as swimming from the beautiful beach.

Sept. 11: Satonda Islands/Labuan Haji Reef. Visit Satonda, a tiny island located off Sumbawa's northeast coast. Walk the beautiful shell-strewn beaches, visit with the local people, or dive in the rich waters. This afternoon we'll make an expedition stop at Labuan Haji Reef. Tonight, the captain hosts a Farewell Dinner.

Sept. 12: Disembark the ship and spend time in the colorful fruit and vegetable markets of Denpasar. Spend the rest of the afternoon exploring the town at leisure. Overnight in our deluxe hotel.

Sept. 13: Bali/Los Angeles. Afternoon departure from Denpasar, arriving in Los Angeles the same evening. (We have regained the lost day by crossing back over the International Date Line). Optional overnight in Los Angeles with morning return to Chicago September 14

FIELD MUSEUM TOURS

You may also choose to continue to the Yogyakarta/Borobudur extension:

Sept. 13: Yogyakarta. Transfer to hotel. Explore the art and batik galleries, or simply enjoy the sights and delicious smells of this ancient city, known as the cultural center of Java.

Sept. 14: Borobudur. Take an unforgettable visit to one of the greatest wonders of the world—the mighty Borobudur temple. Believed to have taken 10,000 workers 10 years to build, it rises 10 terraces, each smaller than the one below it. In the afternoon view the Sultan's Royal Palace. Completed in 1757, it is treasured as an archetype of classical Javanese architecture. Return to hotel for dinner and cultural show.

Sept. 15: Bali/Los Angeles. Return to Bali for departure transfer. Optional over-night in Los Angeles, returning to Chicago the morning of September 16.

PRICES FOR BASIC TOUR
Explorer Deck: $3,940-$4,265
Yacht Deck: $4,805-$5,110
Boat Deck: $5,795
Suite: $6,695

Rates are per person, double occupancy. Air transportation from Chicago to Los Angeles is not included. A tax-deductible contribution of $200 to Field Museum of Natural History is included.

Price for Optional Tour: $290.00 per person; double: $350.00 per person, single. (Includes air transportation, hotel, meals, transfers and sightseeing tours.)

ENGLISH HOMES and GARDENS

July 4-July 15

Tuesday, July 4: Tour members will be met by the local tour director at London Heathrow, Terminal 4 (British Airways). Board a luxury coach for the short journey to Canterbury, where we will be met by our hostesses and driven to their homes. Lunch with the hostesses, followed by a restful afternoon and dinner with hostesses this evening.

Wednesday, July 5: Sandwich Nature Reserve & Canterbury. First to Sandwich Bay Nature Reserve for a conducted coastline walk to see the wildflowers there. Stop at a pub for lunch, before continuing on to Canterbury for a private tour of this great cathedral, for those who wish. Followed by free time to wander or explore before returning to hostesses in the late afternoon. Dinner this evening in a private home.

Thursday, July 6: Ladham and Great Dixter. First a short drive to the West, towards the county of Sussex to visit Ladham, the home of Betty, Lady Jessel, who will personally conduct a tour of her gardens. A pub lunch in Goudhurst, followed by another short journey to Great Dixter, a small gem of a house, built in about 1450, which now has a most interesting garden, created and maintained by the author and broadcaster, Christopher Lloyd. The grounds include areas of native wildflowers and grasses. Return to hostesses and later on dine in a private home.

Friday, July 7: Leeds Castle and Sissinghurst. First a private visit to Leeds Castle, including its gardens and aviary, which was described by Lord Conway as "the loveliest Castle in the world." Drive on through the Kent countryside to Sissinghurst Castle, for lunch in its restaurant. In the afternoon, visit its well-known, and very beautiful gardens, created by Vita Sackville-West and her husband, Harold Nicholson. Dine this night with hostesses.

Saturday, July 8: Heaselands. Goodbye to Canterbury hostesses and first drive to Heaselands, the home of Mrs. J. N. Kleinwort, for a private tour of her seventeen-acre garden, conducted by her head gardener. This outstanding garden was created by Mrs. Kleinwort and her late husband over a period of thirty years. A pub lunch close to Sheffield Park, before travelling on North and West to the Cotswolds to meet, and later dine, with hostesses there.

Sunday, July 9: The Cotswolds. In the morning, an opportunity for those who wish, to worship before luncheoning with hostesses. In the afternoon, visit Hidcote, a lovely garden created by the American horticulturalist, Major Lawrence Johnston. Hidcote is a series of small gardens, surrounded by walls and hedges, contained within the whole. Dine this evening in a private home.

Monday, July 10: Oxford and Blenheim. In the morning we visit Oxford for a tour, first of its Botanic Gardens, followed by a general tour of Oxford colleges, for those who wish. Lunch in a private home. In the afternoon visit Blenheim Palace, home of the 11th Duke of Malborough, and birthplace of Sir Winston Churchill. Dinner this evening will be with hostesses.

Tuesday, July 11: Travel to Bath. Farewell to Cotswold hostesses, and board the coach for a short drive South to Barnesley. Here, the well-known gardening author Rosemary Verey will personally conduct a tour of her outstanding gardens, which surround her delightful South Cotswold house. Lunch in the local pub, and in the afternoon, continue to Bowood, the family home of the Earl of Shelburne, to see both the house and its gardens. The Robert Adam Diolетian houses magnificent rooms and a 5,000-volume library. In the gardens the collections of trees and shrubs include 153 species and over 900 varieties, all of which are labelled. Later in the afternoon, continue to the Bath area to meet, and later dine, with Bath hostesses.

Wednesday, July 12: Bath. In Bath we tour this elegant Georgian city with its outstanding crescents, not the least of which is the Royal Crescent, claimed to be the finest in Europe. Lunch in a restaurant in town. In the afternoon, a choice either to stay in Bath to shop and explore, or to visit Wells for a private tour of its eight-hundred-year-old cathedral. Return to hostesses in the late afternoon, and later this evening, dine in a private home.

Thursday, July 13: Wilton and Heale. We drive south down the lovely Wylie Valley to Wilton House, just North of Salisbury. Visit the home of the 17th Earl of Pembroke to see its magnificent State Apartments, including the famous Double Cube Rooms, and one of the finest art collections in Europe. The gardens contain an interesting variety of trees, including the Golden Oak tree and giant Cedars of Lebanon. Roses are a feature and Lord Pembroke recently opened an Old Rose Garden. After a pub lunch, visit Heale House, the home of Mrs. David Rash, with its superb five-acre garden. Shrub roses and perennials are a prominent feature, together with Japanese tea house and magnolias. Return to hostesses in the late afternoon to dine with them.

Friday, July 14: Travel to London. Goodbye to Bath hostesses and drive east to the Royal Horticultural Society Gardens at Wisley. These gardens, which extend over 470 acres, are "working gardens," with every plant and flower or shrub labelled. They are a joy for both the serious and amateur gardener, or horticulturalist. Lunch in the garden's restaurant. In mid-afternoon, continue into central London and check into the Naval and Military Club, located in the heart of London's West End, where we will be the guests of Lt. Colonel Ronnie Adam. He will host a Welcome to London Reception in the Club for Tour Members this evening. Dinner by own arrangements.

Saturday, July 15. A free day for Tour Members to pursue their own interests, either shopping or sight-seeing. The booklet in the personal folders given to each guest on arrival in England list places of interest in London, how to get there, and times of opening. The tour director will assist in putting together the day's program, for those who wish. Lunch and dinner by own arrangements.

Sunday, July 16. Those returning home this day will be escorted to the departure airport by the tour director for the return flight home. Additional night's accommodation may be arranged at the Naval and Military Club for those wishing to stay on longer in London, subject to availability.

As you see, we will visit a number of outstanding gardens, and your enjoyment will be enhanced by the leadership of Bertram G. Woodland, a former curator at Field Museum, who will accompany the group throughout the tour. Additionally, the opportunity to stay in private homes and share the hospitality of the English hostesses, and the overnight stay at the Naval and Military Club should offer some delightful and interesting experiences. We hope you will join us for this very special tour.

PRICE $3,500. (includes $100 tax-deductible contribution to Field Museum)

For reservations, call or write Dorothy Roder (322-8862), Tours Manager, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Il 60605

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FIELD MUSEUM OF NATURAL HISTORY BULLETIN

March 1989

Hummingbirds: Their Life and Behavior

Slide-Lecture

Sunday, March 12

Field Museum of Natural History Bulletin

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COVER

The ruby-throated hummingbird (*Archilochus colubris*) getting his nourishment from the flower of a trumpet vine, or trumpet creeper (*Campsis radicans*). Hummingbirds are the feature of a slide lecture on Sunday, March 12. See 'Events.'

Photo © copyright Robert A. Tyrrell 1989.

The City Musick Performs March 10

On Friday, March 10, City Musick performs "La Resurrezione," Handel's first oratorio in its Chicago premiere for orchestra and soloists. James Simpson Theatre at 8 pm. Ten percent discount on tickets for Field Museum members. Call City Musick at 642-1766.

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EVENTS

Ruby-throated hummingbird © 1989 Robert A. Tyrrell

Hummingbirds: Their Life and Behavior

Robert A. Tyrrell and Esther Quesada Tyrrell
Photographer and Author

Sunday, March 12, 1:30pm

Most of them are less than three inches long and weigh less than a penny. Among the most acrobatic of birds, they can fly forward, backward, upside down, and hover. Their tiny wings can beat as fast as 80 times a second. They have such romantic names as Sappho comet, adorable coquette, and collared Inca. They are the flying jewels of the Trochilidae family: the hummingbirds.

Hummingbirds are among the most difficult birds to capture on film. Their tiny stature and rapid movement have eluded photographers for years. With the help of engineering experts from the Massachusetts Institute of Technology, photographer Robert Tyrrell has mastered the high-speed photography required to stop these tiny creatures in action. He is considered the world's foremost photographer of hummingbirds.

In a slide-lecture presentation, based on their highly acclaimed book, *Hummingbirds: Their Life and Behavior*, the Tyrrells present the brilliant world of hummingbirds. Using Robert's slides, Esther Tyrrell discusses aerial dynamics, plumage, food, courtship, aggression, and nesting, while focusing on the 16 North American species. She also looks at the difficulties encountered in photographing hummingbirds. As Robert says, "The largest problem I encountered was 'stopping' their wings. Not only because of their whirring, but also because the shimmering, iridescent feathers can change color and lose their luster if not photographed from the precise angle." The lecture continues with discussions of the role of the hummingbird in Native American ritual, art and legend.

Share the Tyrrells' experiences of tracking and "shooting" the birds, the trials of tidal waves, flowers blooming out of season, shifts in migration patterns, and the triumph of a completed project.

LL89101 Hummingbirds: Their Life and Behavior
Tickets: $6 ($4 members)

Please use the coupon p. 4

EVENTS

Weekend Programs

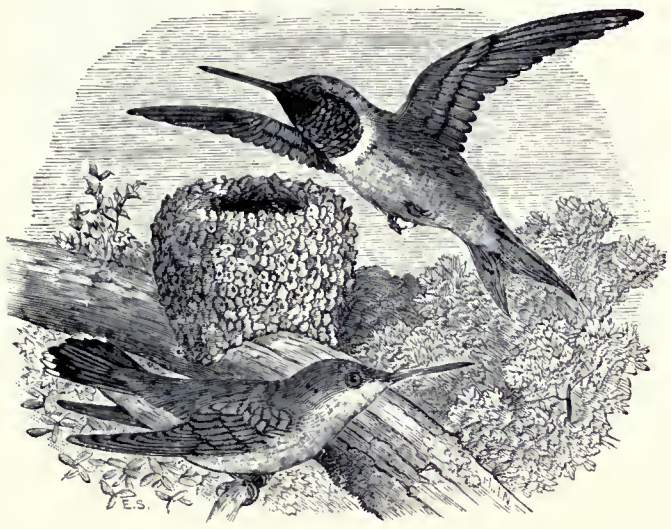
Each Saturday and Sunday you are invited to explore the world of natural history at Field Museum. Free tours, demonstrations, and films related to ongoing exhibits at the Museum are designed for families and adults. Listed below are some of the numerous activities offered each weekend. Check the activity listing upon arrival for the complete schedule, and program locations. The programs are partially supported by a grant from the Illinois Arts Council.

March

4, 11 12:30pm *"Museum Safari"*
Trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon, big game from Africa and seals from the Arctic.

18 1:30pm *Tibet Today* and *Bhutan, Land of the Thunder Dragon.* See Lhasa and other towns now open to tourists, and examine important Buddhist sites during this slide lecture and tour.

These programs are free with Museum admission and tickets are not required.



World Music Programs

Weekends in March
1:00pm and 3:00pm

Program highlights include:

☐ *March 4 and 5*
1:00pm—Light Henry Huff plays contemporary jazz harp.
3:00pm—Librado Salazar plays classical guitar.

☐ *March 11 and 12*
1:00pm—Thunder Sky drummers play African percussion.
3:00pm—Amira demonstrates shakere.

☐ *March 18 and 19*
1:00pm—Fan Wei-Tsu demonstrates the sheng, a Chinese zither.
3:00pm—Keith Eric plays Jamaican rhythms.

☐ *March 25 and 26*
1:00pm—Chinese Music Society of North America demonstrates instruments from the Chinese orchestra.
3:00pm—Chicago Beau plays blues harmonica.

The World Music Program is supported by the Kenneth and Harle Montgomery Fund and a CityArts grant from the Chicago Office of Fine Arts, Department of Cultural Affairs.

Registration for Hummingbird Slide-Lecture

Be sure to complete all requested information on this registration application. Registrations are confirmed by mail. For registrations received less than one week before the program date, confirmations are held at the West Door for pick-up one hour before the performance begins. Phone registrations are accepted using Visa/MasterCard/AMX/Discover. Please call (312) 322-8854 to register. The minimum amount for credit cards is $15.00. For further registration information, consult the January/February/March Adult, Children, and Family Program Brochure.

Return complete registration with a self-addressed stamped envelope to:

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LL89101	Hummingbirds: Their Life and Behavior			

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FIELD BRIEFS

Distinguished Scientist Award to Robert F. Inger

The Department of Zoology proudly announces the honorary appointment of Dr. Robert F. Inger, curator of Amphibians and Reptiles, as Distinguished Scientist of Field Museum. Dr. Inger is a skilled naturalist and world authority on the systematics and natural history of amphibians and reptiles, especially of the Far East. Dr. Inger is well recognized in the scientific community for his biogeographic, systematic, and faunal studies, and for his important papers on the ecology of rain forest communities in Southeast Asia. Most recently, he has been working annually in Sabah (Island of Borneo), where he is an honorary curator and professor at the Sarawak Museum in Kuching, Sarawak, Malaysia. Throughout his career, Dr. Inger provided generous service to the scientific community as editor or member of the editorial boards of four international scientific societies, and as program director for Environmental Biology during a two-year appointment at the National Science Foundation. On the basis of his record of innovative research and service to the scientific community, Dr. Inger's colleagues elected him to the presidencies of three international societies: the American Society of Ichthyologists and Herpetologists, the Herpetologists League, and the Society of Systematic Zoology. In addition, he was elected to the vice-presidency of the Society for the Study of Evolution. Dr. Inger's outstanding achievements in many areas of science, both in the national and international arenas, make him a most deserving recipient of Field Museum's first Distinguished Scientist appointment.

Larry Heaney Joins Mammals Staff

The Department of Zoology's most recent member is Larry Heaney, who has been appointed assistant curator of Mammals. A native of Washington, D.C., where he attended high school, Heaney earned his bachelor's degree at the University of Minnesota and his M.A. and Ph.D. at the University of Kansas. His special interests include evolutionary biogeography, particularly concerning the mammals of Southeast Asia.

Timothy C. Plowman 1944 - 1989

Timothy C. Plowman, a member of the Botany Department staff since 1976, died on January 7 after a long illness. He served as chairman of the department from 1986 to 1988 and at the time of his death was curator.

Dr. Plowman grew up in Harrisburg, Pennsylvania, and attended college at Cornell University. His graduate studies at Harvard resulted in a Master's Degree in 1970 and a doctorate in 1974. His research interests at Harvard, under the guidance of Richard Evans Schultes, focused on ethnobotany and plant systematics. Though his systematic studies began with *Brunfelsia* (tomato family), he soon focused on the taxonomy and ethnobotany of *Erythroxylum* (coca) as his primary interest. He did intensive fieldwork and collecting in tropical South America, Central America, and the Caribbean. Because he interacted so well with many diverse scholars, he was able to promote a wide range of interdisciplinary studies regarding the archaeology, ethnobotany, chemistry, and pharmacology of coca and other economic plants.

He became tenured at the Museum in 1983 and was appointed curator in 1988. He published over 60 scientific papers, many of them dealing with ethnobotany and ethnopharmacology. He served as the editor of the Museum's journal, *Fieldiana*, for four years, and served in an editorial capacity for several other journals. During his two years as chairman of the Botany Department, he obtained a substantial increase in NSF funding for the herbarium, and he developed a new facility for the curation of the economic collections. His strong motivation and high professional standards were evident in all his work, and these attributes made him an effective chairman and editor. His collecting of research materials for others and his commitment to providing identifications made him many friends.

The Department of Botany has established the Timothy C. Plowman Fund for South American Research. Contributions may be made to this fund through the Department of Botany.

INDIANS OF THE WESTERN GREAT LAKES— They Are Still Here

by Helen Hornbeck Tanner

The original inhabitants of the western Great Lakes, now commonly called "Indians" or "Native Americans," have left traces of their presence as long as ten or twelve thousand years ago in this region, though the record of continuous existence is clearly evident for the last four thousand years. For Indian people who still live near Chicago and Lakes Michigan, Superior, and Huron, their traditional history consequently covers many centuries of time in North America. By contrast, all other present-day inhabitants are but recent immigrants whose homelands are across the oceans on other continents.

To appreciate the native American perspective regarding regional history of the western Great Lakes, it may be helpful to use the device of an imaginary long-run film that would cover 250 years an hour, and so take sixteen hours to record the 4,000-year span of time. All the actors would be Indian people for more than fourteen of those sixteen hours. If the film began at 8 a.m. and ended at midnight, the first French explorers would not appear in the present Chicago area until about 10:40 p.m., and American settlers would not arrive on the scene until about 11:25 p.m. In this long-range view of the regional past, Americans who have all come from other parts of the world represent a thin surface-layer of very recent but nevertheless traumatic developments that rapidly transformed the western Great Lakes country.

The many centuries of time before the arrival of Europeans were not static for the original inhabitants. The lakes and river systems, along with the overland trails, provided a communication system that kept native communities of the western Great Lakes in touch with the Atlantic Seaboard, Gulf Coast, Rocky Mountains beyond the Great Plains, and the north country towards Hudson Bay. The frequency of such contacts varied over the centuries, as population centers formed and later broke up when groups dispersed and moved about. Alliances fostered intercommunity contacts, while enmities created barriers.

The greatest era in the past history of eastern North America occurred during the period around A.D. 1150, when a flourishing metropolis with a population estimated at 10,000 existed at Cahokia, Illinois, across the Mississippi River from present St. Louis, Missouri. Including satellite towns and ceremonial mounds on both sides of the Mississippi, the regional population may have been as high as 40,000. Cahokia was well placed in the middle course of the Mississippi River, a main artery of north-south travel, and close to entrances of both the Missouri and Ohio rivers. By land trails to the Southwest, Cahokians traded with other prosperous and highly developed towns in present Louisiana and east Texas.

Native people throughout the western Great Lakes had contacts with Cahokia and built their own local mounds, but did not live in villages large enough to maintain the complex society of the great ceremonial and trade center on the Mississippi River. The people on the upper Illinois River, around the base of Lake Michigan, and in southwestern Michigan lived in the hinterlands. The impressive city of Cahokia was not an enduring metropolis, but dwindled and broke into smaller hamlets by A.D. 1300, during a period when similar population decline and dispersal was occurring in other sectors of the present United States. One distant offshoot of Cahokia was established in southeastern Wisconsin at present Azatlan, where signs of the mounds and palisaded fortifications are still visible.

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The arrival of Europeans on the Atlantic and Gulf coasts, beginning with the Spaniards in the early 1500s, led to far-reaching changes along the Seaboard and even in the vast interior drained by the Mississippi River system. Drastic decline in population, the consequence of the introduction of such diseases as measles, whooping cough, and smallpox to which the Indians had no resistance, destroyed an estimated 75 to 90 percent of the native people living in the Southeast by about 1580. For the area north of the Ohio River, including the upper Mississippi valley and the western Great Lakes, there is no generally accepted estimate of the possible loss of life as a result of the further spread of sixteenth-century epidemics.

The full impact of changes brought about by Europeans on the seacoasts did not reach the western Great Lakes until the middle of the seventeenth century. The era of profound changes was preceded by the advance of French explorers up the St. Lawrence River to create a new base at Quebec City in 1608. At virtually the same time, English settlement began at Jamestown, Va., and Dutch representatives sailed up the Hudson River to establish a fortified trading post at present Albany, New York. The introduction of European trade goods, and the demands for increasing numbers of beaver pelts in exchange, set up intercolonial and intertribal animosities that first disrupted the lower Great Lakes region of present New York and Ontario. Merchants in all the colonies promoted the lucrative trade in furs with native people, who were eager to acquire iron hatchets, knives, and copper kettles. These European wares were obviously superior to their own stone tools and pottery and bark containers. Native people also were in the market for luxury goods, fancy coats, and shirts, ribbons, and articles for personal adornment. Essentially, leaders among the various Indian coalitions were competing to control the distribution of European imports to their native trading partners, and at the same time trying to monopolize the supply of beaver pelts from an expanding hunting territory for trade with their European allies. The pattern of minor raids and skirmishes characteristic of traditional Indian fighting developed into wholesale economic warfare supported by rival European powers also at war with each other. The period of intensified warfare was accompanied by waves of epidemic disease that destroyed a third to a half of the regional population. Prior to the arrival of Europeans in the western Great Lakes, one epidemic spread to east-central Wisconsin, virtually annihilating the Winnebagos.

The introduction of firearms changed the nature

Ribbon appliqué skirt, Sauk and Fox. Cat. 17589
neg. 110964c

Pair of beaded garters, Potawatomi. Cat. 155680
Photo by Ron Testa, neg. 111489

of forest fighting previously limited to bow-and-arrow encounters. When the Dutch provided their Iroquois allies with muskets in 1641, they gave these Indians in northern New York a military and psychological superiority that prevailed for half a century. The French became obligated to provide firearms for their supporters, but French guns were not as good and were distributed only to Indians trusted to remain loyal. After the Iroquois acquired firearms in the 1640s, their next target became the Hurons, another group of Iroquois speaking people with an extensive trading empire based at their towns near Lake Simcoe, north of present Toronto, Ontario. The Huron country enjoyed a unique climatic advantage as the most northern locale where corn could be raised. The Huron and their Ottawa allies traded corn through a network that extended north of Lake Superior to Hudson Bay and westward to Green Bay, Wisconsin, where the Fox-Wisconsin river route provided the principal gateway to the upper Mississippi River and western prairies.

Iroquois attacks drove the Hurons from their homeland, many succumbing to hunger and disease at a temporary encampment on Christian Island in Georgian Bay, Lake Huron. The long odyssey of the refugee Hurons and their Ottawa companions continued to an island at the head of Green Bay, then to the upper Mississippi River below present Minneapolis-St. Paul, where Dakota (or Sioux) opposition forced their retreat back to the south shore of Lake Superior. Meanwhile, Indians of the western Great Lakes district were congregating near Green Bay, home ground for the Menominee and Winnebago, forming an intertribal refugee community estimated at 10,000 people. Among the refugees were Illinois Indians, Miamis from the Wabash River country of northern Indiana, and Potawatomis from southwestern Michigan. The population density strained the agricultural and other food resources of the Green Bay region. Iroquois attacks on the northern sector of the Great Lakes subsided after Ojibwa warriors defeated an Iroquois raiding party near

the Lake Superior outlet into the St. Marys River in 1662.

Iroquois military activity entered a new phase after the English replaced the Dutch in the Hudson River valley in 1669. Since they had dispersed or incorporated their immediate neighbors, Iroquois attacks from northern New York in the 1670s next swept down the Ohio River through Shawnee country to southern Illinois, and followed the route south of Lake Erie, continuing overland to northern Illinois. Iroquois inflicted a heavy blow on the Illinois village near the mouth of the Illinois River in 1680, and struck Miami Indians encamped near present Chicago in 1687. The series of offensive actions ended in 1691, when the Illinois and their allies repulsed the Iroquois siege at Starved Rock, on the upper Illinois River near present Utica, Ill. The intertribal community at Starved Rock, including resident Illinois, as well as Miami and Shawnee refugees, had collected around the fort established by LaSalle during his first trip downriver in 1682.

Thereafter, western Indians allied to carry a counter-offensive aided by French troops into Iroquois territory. Under French auspices, a general peace treaty took place in Montreal in 1701. An important provision of the treaty was the agreement that the Iroquois could hunt peacefully in Canada, and the Ottawa could pass undisturbed through Iroquois territory to trade at Albany. Among the participants in the conference were leaders from all the western Great Lakes Indians: Huron, Ottawa, Ojibwa (Chippewa), Menominee, Potawatomi (who also represented the Sauk), Winnebago, Mesquakie (Fox), Illinois, Kickapoo, Mascoutin, and Miami. The Kaskaskia village leader from southern Illinois made the longest journey to attend, though there were also representatives from Temiscaming, on the headwaters of the Ottawa River in northern Ontario. Closer to Montreal were the Indian mission communities of Mohawk, Algonquin, Abenaki, and Huron located in the lower St. Lawrence River valley. Only four of the Five Nations of Iroquois participated in the Montreal peace conference: Seneca, Onondaga, Cayuga, and Oneida. Later, the Mohawk added their approval. In peace-making, as in warfare, trade, and diplomacy, western Great Lakes Indians carried on constant intertribal activity, but the Montreal council was a special event.

Before the final peace treaty was signed in 1701, adjustments began to take place in the western country. Miamis and Potawatomis began to leave Green Bay, moving toward their home territory in southwestern Michigan and Indiana. Largely because prices for furs declined drastically in European markets, the French king ordered the cessation of licensed trading and the abandonment of posts throughout the Great Lakes in 1696. This decision forced Indian hunters to deal with the illegal traders, the *coureurs de bois*, or to seek distant English markets at Hudson Bay or Albany. On the mission frontier, French missionaries shifted southward to found a new center in Illinois at Cahokia, on the east bank of the Mississippi 20 miles south of the mouth of the Illinois River. This mission served nearby Illinois Indian villages, Cahokia, Tamaroa, and Kaskaskia, and French *habitants* who began farming the fertile Mississippi bottomlands in 1700.

The significant new development following the peace treaty was the establishment of a new French base at present Detroit, Michigan in the fall of 1701, when safe travel was assured from Montreal through Lake Ontario and Lake Erie and the surrounding country. From this solitary outpost in the western Indian country, the French commandant promoted the fur trade in a new direction, the Ohio country. Leading the Indians who came to settle at the new location were the Hurons, who ended their half-century of wandering at new headquarters on the Detroit River. Their Ottawa friends and two groups of Potawatomi were other long-term residents of the Detroit region. North of Detroit, the St. Clair River district became the home of Ojibwas from Sault Ste. Marie and the north shore of Lake Huron.

The period of shortages in European merchandise was alleviated after a rise in the price of furs made reopening the western Great Lakes trading posts economically feasible. In 1715, new Fort Michillimackinac—Ojibwa name for the straits region—was constructed on the south shore at present Mackinaw City, Michigan. This site was the crossroads of commerce for the entire western Great Lakes region, the summer gathering place for *voyageurs*, traders, and thousands of Indians who joined in intertribal ceremonies and celebrations. Subsidiary posts with military detachments were later established as far south as Fort Chartres, near the French and Indian villages of southwestern Illinois, and westward along the Rainy River route from Lake Superior to Lake of the Woods on the present Minnesota-Canadian border.

For Indian people, French military posts offered not only hunting supplies and foreign merchandise, but also the services of blacksmiths and other artisans who could produce metal tools, sharpen axes and knives, and repair guns. Some traders spent the winters with Indians when they dispersed to hunting camps, married

Indian women, and became part of the kinship network.

Yet, Indians never received Europeans in their midst with total enthusiasm, and periodically tried to halt the increase in foreign influence within Indian country. Resistance was most forcefully demonstrated in a series of armed conflicts protesting trade control and pricing, military actions, and takeover of Indian hunting grounds for agricultural settlement. In defense of their own families, homes, and country, Indian warriors fought French, British, and American armies as well as local militia units.

Ironically, the armies all had Indian contingents, so the fighting also involved intertribal and native civil war. After Indian people were forced to surrender their lands to the American government in the curious procedure of land-cession treaties, the confrontation continued as cultural conflict with the policies of the federal Bureau of Indian Affairs. Indian people were reluctant, even under government pressure, to change their language, religion, values, family life, and the way they raised their children.

The first major opponents of foreign intrusion into the western Great Lakes were the Mesquakies living along the Fox River above the entrance to Green Bay. By blocking the Fox River, the Mesquakies prevented the French from using the important water route from Green Bay to the Mississippi River by way of the Fox and Wisconsin rivers with a portage at present Portage, Wisconsin. In a series of campaigns from 1712 to 1737 known as the "Fox Wars," the French fought the Mesquakies, who received aid from sympathetic neighboring tribes, the Sauks, Kickapoos, Mascoutens, and Dakotas. This combination carried aggressive warfare against the Illinois, strong supporters of the French, as a consequence of Christianization and intermarriage. In their ultimate determination to annihilate the Mesquakies, the French with Indian assistance including Christian Iroquois, drove the Mesquakies from their villages on the Fox River and marshalled 1,400 fighting men to carry out a devastating attack on their refugee stronghold in present McLean County, Illinois. French officials transported some of the Mesquakie prisoners to Martinique to be sold as slaves, but Caribbean plantation owners heard of the warriors' ferocity and refused to accept them as gifts. The last of these Mesquakies were taken to the coast of South America.

When warfare ended, the Kickapoos and Mascoutins left southern Wisconsin, accepting the invitation of the Miami to settle on the Wabash River in Indiana. The remaining Mesquakies moved west to the Mississippi Valley and became closely associated with the Sauks. By 1737, the new center for the Sauk was Saukenuk, at present Rock Island, Illinois. Twelve years later, one other group of Mesquakie left the western Great Lakes to relocate at a Delaware village in northwestern Pennsylvania.

In 1747, other tribes in the Great Lakes region demonstrated their dissatisfaction with French intrusion. One faction of Hurons who had moved permanently to northern Ohio plotted unsuccessfully to seize the fort at Detroit. In other incidents the same year, French traders were killed near Lake Erie, in the Saginaw Valley of eastern Michigan, and in the Illinois country.

But the Miamis, Hurons, and Shawnees who had recently regathered in southern Ohio presented a more serious challenge to French authorities by accepting British traders from Pennsylvania in their towns. French soldiers and Ottawa allies from Michillimackinac swept down to the Ohio country and restored French control over the Indian trade before the beginning of the next hostilities in the zone contested by rival colonial empires—hostilities known as the French and Indian War (1753-60). Indian leaders protested in vain against European use of Indian lands for fighting their imperial battles. Nevertheless, many Iroquois from New York joined the British, and most western Great Lakes Indians sided with the French, taking prisoners and booty in hostilities along the Pennsylvania frontier. Hurons and Potawatomis, according to their own tradition, brought back to their villages the first horses owned by these tribes. In 1757, 850 Great Lakes Indians joined French forces in the expedition across northern New York to seize Fort William Henry at Lake George. Menominees from Green Bay and Potawatomis from the St. Joseph River of southwestern Michigan unfortunately entered the smallpox ward of the military hospital and carried the infection back to their home communities. The war ended in this theatre after the British victories at Pittsburgh in 1758 and Montreal in 1760.

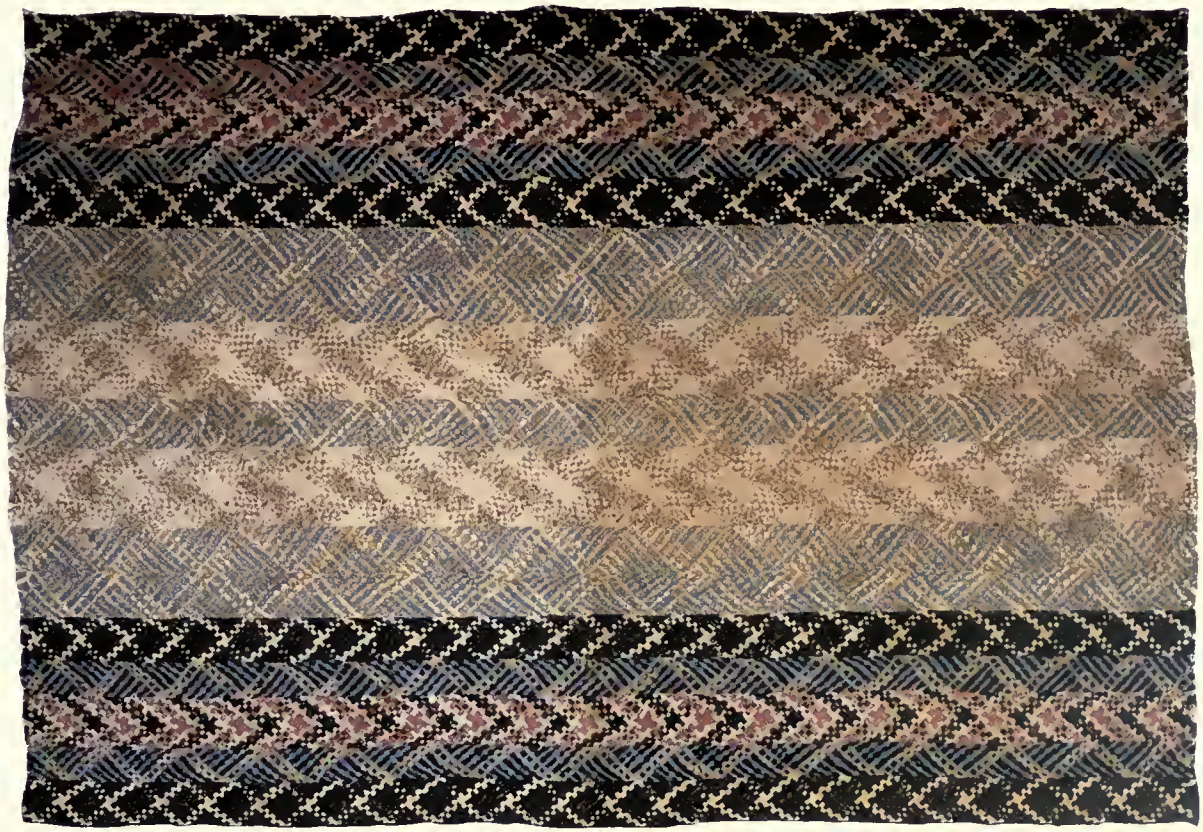
The arrogance of the British officers sent to take over the French military posts, and the curtailing of expected gifts—a vital part of amicable Indian transactions—aroused general dissatisfaction among Indian communities throughout the Great Lakes and upper Ohio Valley. Under the leadership of Pontiac, an Ottawa leader living near Detroit, warbelts were secretly circulated to coordinate attacks on the new British military units. In May and June 1763, Great Lakes In-

dians forced the British to surrender nine posts: Fort Michillimackinac on the straits between Lakes Huron and Michigan; Fort Edward Augustus at Green Bay, Wisconsin; Fort St. Joseph at Niles, Michigan; Fort Ouiatenon at present Lafayette, Indiana; Fort Miami at present Fort Wayne, Fort Sandusky in northern Ohio, and three posts on the northwestern Pennsylvania frontier. The first six were in localities with small French and *metis* (Indian and White) civilian populations engaged in trading and farming. The British held out in only two western forts, Pittsburgh and Detroit.

Pontiac ended the six-month siege of Detroit in late October, 1763 after an early snowfall forecast the need to begin winter hunting, and after a French messenger arrived from Fort Chartres, Illinois, bringing first news of the terms of the Treaty of Paris signed in June, 1763. This treaty ended the global warfare in which the North American Indians had become involved. In European, but certainly not in native American perception, the treaty transferred to Great Britain all the French territory east of the Mississippi River, but the New Orleans district and Province of Louisiana west of the Mississippi went to Spain. Pontiac did not really believe the report of the peace terms, and he went to Fort Chartres, still hoping for French assistance. The French communities in southwestern Illinois, as well as Vincennes in southern Indiana, were not part of Canada, which admittedly had been conquered, but were on the northern edge of French Louisiana. Illinois Indians made a futile appeal to the French governor in New Orleans, and sympathetic Indians prevented British occupation of Fort Chartres until Pontiac agreed to make peace in 1765. No longer a war leader, Pontiac's influence faded before his murder in 1769.

Though the French left the Great Lakes Indian country, native leaders still had diplomatic alternatives when the Spanish established headquarters for Upper Louisiana in 1770 at St. Louis, Missouri, founded by French from Illinois in 1764. The Spanish presence in the Mississippi Valley until recession to France in 1802 and subsequent purchase by the United States in 1803, brought a new element into the western Great Lakes frontier. During the next quarter-century, the Illinois, beleaguered Shawnees, and their Cherokee allies, the Delaware, Kickapoo, and Miami, sought Spanish protection on the west bank of the Mississippi River.

In the years following the general uprising associated with Pontiac, the principal concern of all Indian people west of the Appalachian mountains was the prevention of further loss of land to the advancing white



Floor mat, Potawatomi. Cat 155711
Photo by Ron Testa. neg 110293c

Quilled cover of birchbark box, Ottawa (?), Cat. 258673
neg 101964c

frontier. At an intertribal congress held at Fort Stanwix, New York in 1768 under auspices of the British superintendent of Indian Affairs, 3,000 Indians present believed they settled the vexing problem of white encroachment. The Treaty of Fort Stanwix stated that the permanent boundary between white settlements and Indian country was the Ohio River. On the other hand, the British army could not control the lawless inhabitants of the frontier.

The intense struggle of Indian people to maintain the Ohio River boundary line, protecting their villages, cornfields, and hunting grounds, began immediately. The first military engagements occurred in southeastern Ohio in 1774, and fighting continued in Ohio and Indiana for twenty years as an extended vendetta between Kentuckians and Great Lakes Indians. In 1774, when the first Indian towns in Ohio were destroyed, only 400 Americans occupied fortified camps in Kentucky. The numbers grew rapidly as ponies and wagons crossed mountain trails and flatboats descended the Ohio River—often braving Indian fire—to increase Kentucky's population to 73,000 in 1790.

The American Revolution complicated the Indian strategy after 1775. Delawares living closest to Pittsburgh, the most western military base of the Revolutionary army, felt constrained to cooperate with the Americans, who had never undertaken to march on British-held Detroit. In turn, American authorities agreed to recognize the Ohio River boundary established under the British regime, and in a later 1778 treaty held forth the promise of establishing a separate Delaware state within the American confederation. But that same year, members of the Indian staff at Pittsburgh fled to join the British Indian service in Detroit. British relations with Indians improved markedly with the addition of the new recruits, former Indian captives with many contacts through trading enterprises and knowledge of several Indian languages.

After the American colonies gained their independence in 1783, government officials first insisted that Indian people had to surrender the long desired land in southern Ohio because they were allies of the defeated British. Indian spokesmen asserted that the British king had no right to give away Indian land and George Washington had no right to accept it. The secretary of war later modified his view, admitting that the Indians had "rights to the soil," but asked that if they sold any land they should deal with the American government. Long before Americans actually secured Indian land in the Great Lakes, the Northwest Ordinance of 1787 outlined plans for future government, including the unrealistic statement "The utmost good faith shall always be observed toward the Indians, their lands and property shall never be taken from them

without their consent." Legislation and frontier warfare were separate matters.

As the fighting strength of the western Pennsylvania and Kentucky militia grew, the three thousand or so Shawnees, Senecas, Delawares, and Wyandots (British term for Hurons) nearest the frontier were driven northwest across Ohio by stages. From 1790 to 1794 they made their final stand along the Maumee and upper Wabash rivers, there joined by Indian allies and supported by the British Indian Department in Detroit. Although the Great Lakes confederacies defeated the first expeditions sent from Cincinnati, the well-trained army under General Anthony Wayne along with the Kentucky militia gained a victory at the Battle of Fallen Timbers, near Toledo Ohio, in 1794. The same year, the British agreed to vacate Detroit and the Straits of Mackinac. In 1795, several thousand Indians assembled at Greenville, to sign the treaty ceding the southern two-thirds of Ohio and in effect giving up the Ohio River boundary line. The end of the warfare opened the Ohio country to a flood of white settlers. By 1810, the state of Ohio had a population of 230,000.

Indiana and Illinois soon became the next focus of conflict between Great Lakes Indians and Americans. Indian antipathy toward white settlers intensified after Tenskwatawa, the Shawnee prophet, began preaching in 1805 in the Delaware towns on the White River of Indiana, where they relocated after their homes in Ohio were destroyed. The prophet's message urging rejection of white society, spread through the Great Lakes and beyond. In 1807, when war between Great Britain and the new American republic was already predicted, the prophet's followers held an intertribal council at the Grand Kickapoo village near the head of the Sangamon River in central Illinois. Headquarters for the new militant coalition was established among the Potawatomis, at the juncture of the Tippicanoe and Wabash Rivers in Indiana. Prophetstown was soon surrounded by encampments of Kickapoos, Winnebagos, Miamis, and a faction of Wyandots. The Shawnee prophet's charisma diminished after the governor of Indiana Territory, William Henry Harrison, made a successful surprise attack on Prophetstown in November 1811. Already the prophet's brother, Tecumseh, was rising to prominence as a military leader and orator, denouncing further land cession treaties. Settlers from Ohio to Missouri hastily began erecting forts in anticipation of Indian warfare.

At the beginning of War in 1812, both Tecumseh and Tenskwatawa crossed to the Canadian side of the Detroit River to join the British army. The British regained a dominant role among the Indians in the northern sector of the western Great Lakes during the War of 1812. Key figure in organizing Indian military support was Robert Dickson, British trader whose base was among the Dakotas on the headwaters of the Minnesota River, where he had a Dakota wife and family. Upper Great Lakes Indians contributed the principal troop strength when the British regained the strategic Mackinac Island location in July 1812. (Site for the fort had been moved from the mainland to the island in 1781.) From Mackinac Island, Dickson transported Indian contingents to military camps on both sides of the Detroit River and the Niagara River war zone. Many Indian veterans returned to the upper Great Lakes with tales of the "burning of Buffalo."

Chicago became an important, but tragic, site at the outset of active warfare. Fort Dearborn on the Chicago River had been established in 1803 on one of the strategic sites reserved for military fortification by the Treaty of Greenville in 1795. It was situated in the midst of country occupied by intermixed Potawatomi, Ojibwa, and Ottawa who had moved into northern Illinois lands formerly inhabited by Illinois and Sauk. Soldiers at isolated Fort Dearborn carried out orders for evacuation in August 1812, but almost all lost their lives when they were ambushed by hostile Potawatomis during their attempt to gain safety at Fort Wayne. This tragedy occurred within a day of the American surrender of Detroit, leaving Fort Wayne as the American outpost nearest the Great Lakes Indian country.

Following the American evacuation of Fort Dearborn, Chicago and the entrance to the St. Joseph River across Lake Michigan became British bases for operations during the balance of the war era. Dickson set up a blacksmith shop at a hidden village south of Kalamazoo to serve the Indian troops. His lieutenant in northern Illinois was the Sauk leader, Black Hawk, who collected Dakota and upper Great Lakes warriors to oppose American forces in northwestern Ohio.

In southern Illinois, hostile incidents occurred as early as 1811. Territorial government had been in existence only since 1809 at Edwardsville, established in 1805 at the northern margin of white settlement. In 1812, Governor Ninian Edwards launched attacks on the Kickapoo and Potawatomi towns along the middle course of the Illinois River, and succeeded in establishing Fort Clark at Peoria in 1813. In Indiana, Americans carried out systematic campaigns to destroy Delaware towns on the White River, where the Delaware moved after losing their homes in Ohio, but had less success in attacks on Miami towns on branches of the

Wabash River. Main Poc, early admirer of Tenskwatawa and Tecumseh and war leader of the Illinois River Potawatomi, played a major role in Indian military exploits during the war era. In 1812, he moved to the Fox River west of Chicago, then spent the next three years distributing war parties among the Potawatomis west of Detroit. In this hinterland within fifty miles of Detroit, but never penetrated by Americans, Indians grew corn to augment food supplies provided by the British.

Although the American army returned to Detroit in 1813, following victory over the British at the Battle of the Thames and the death of Tecumseh, war on the western margin of the Great Lakes country continued for two more years. In July 1814, British and Indian forces from Mackinac Island captured the American fort at Prairie du Chien at the mouth of the Wisconsin River only a month after it was erected. In response, the military command in St. Louis sent an expedition against the multi-tribal forces collected by Black Hawk around Saukenuk at the mouth of the Rock River. As this war period ended, American commissioners held a series of regional councils in an effort to reach satisfactory peace terms with the large number of recent Indian opponents. Only part of the Winnebagos agreed to accept American protection, and the Menominees held out until 1817. Yet, Great Lakes Indians still retained contacts with the British Indian department. Until 1842, they canoed to posts in Lake Huron or followed the Sauk trail to Fort Malden, opposite Detroit, to receive presents from the British acknowledging their services during the War of 1812.

The final protests from Great Lakes Indians against white intrusion occurred in 1827 and 1832 in response to sudden white invasion of the lead mines district, a triangular area extending north from Galena, Illinois to the Wisconsin River. Until the arrival of a horde of white miners, Mesquakie were digging and selling the ore. The Winnebago attack on a Mississippi River steamboat in 1827 brought immediate military reprisal followed by government demands for land cessions in northwestern Illinois. A new military post to oversee the Winnebago was built immediately at the Fox-Wisconsin portage.

When the new land cessions opened up the country around Saukenuk in 1829, the elderly Sauk leader insisted that the early treaties had excluded his village. Nevertheless, in the fall of 1831, militia forced Black Hawk's band of Sauk and Mesquakie to leave the place that had been their home for almost a century and move across the Mississippi River. When the men, women, and children came back in May 1832, ostensibly to plant corn in their accustomed fields, the action aroused broad-scale military opposition. As the band fled northward, the army command summoned several thousand troops from as far distant as Baton Rouge, Louisiana and Atlantic coast ports. Troops coming from the east brought the first cases of Asiatic cholera to the western Great Lakes, an epidemic largely confined to the military. Unsuccessful in trying to surrender, Black Hawk was captured and his band decimated within two months.

The end of overt Indian resistance came at a time when the opening of the Erie Canal, providing a water route from the Hudson River across New York to Lake Erie, let loose a new population stream that burst westward over the road being built from Detroit to Chicago. In 1830 white settlements in southeastern Michigan existed only as far west as present Jackson, but by 1832 families from New York and New England were settling all along the old Indian trail to Lake Michigan. Potawatomi in southern Michigan gave these newcomers a friendly reception, identifying them as *Saganash*, meaning "Englishman," distinguishing this group from the *Chemokoman*, or "Big Knives," term for Virginians and Kentuckians who arrived on the Great Lakes frontier from south of the Ohio river.

The new tide of population was encouraged by Indian treaties in 1832 and 1833, planning removal of Potawatomi in Michigan and Indiana to reservations west of the Mississippi, and opening up land along Lake Michigan north of Chicago to Green Bay and the Door Peninsula. Yet, the little city of Chicago, established in 1837, still had only 4,853 people by 1840 in a state with a total population of 476,000. From Chicago, the line of settlement moved northward slowly on both sides of Lake Michigan. The Americanization of the northland began as a lumbering and mining frontier. These new enterprises also provided jobs for Indians in logging camps, railroad construction, survey teams, and Great Lakes shipping. The American Fur company and Ottawa and Ojibwas were already engaged in commercial fishing in Lake Superior and the Straits of Mackinac.

At the same time, the federal Office of Indian Affairs introduced new constraints on the remaining Great Lakes Indians, with plans to make Indian people live and even think like members of western European society. Treaties negotiated in 1854 and 1855 covering land in the northern part of the Lower Peninsula of Michigan, the Upper Peninsula, and northern Wisconsin, assigned special sections on reserved land for each local band, to be divided into individual family

farms. On the reservations, missionaries, teachers, and government farmers expected to transform Indian families into Christian, English-speaking, private property-owning, commercial agriculturalists, comparable to the ideal American citizen of the period, even where the land was unsuitable for farming. The net result of the government program for land distribution, a procedure dominated by fraud, was to divert most of the land to non-Indian ownership.

Indian people, in the western Great Lakes as elsewhere, have been reluctant to give up their own way of life, and frankly considered white society morally inferior. The emphasis on saving was viewed as avaricious hoarding in a community where sharing and exchange of gifts were important in life. For Indians, religion was not a separate category, since every act was imbued with religious meaning. Land, like air and water, was a communal resource belonging to, and at the same time the responsibility of, everyone. Personal property was limited to objects personally crafted or acquired by individual effort. High status in the community was accorded the leader on the basis of how much he gave away, not on what he accumulated. A leader had no power of coercion, but was limited to the use of oratory and diplomacy in urging a course of action.

Missionaries and teachers taught Indian children that their ancestors were savages, their language was barbaric, their mode of life was heathen, and their religious beliefs were superstition and witchcraft. In the boarding schools that many Great Lakes Indian children were compelled to attend, corporal punishment was used freely, particularly for speaking a native language. Missionaries gained some converts, particularly among *metis* families more inclined to accept the advantages of cooperation with the government. Indian people were most responsive to the preaching of Indian converts. On the other hand, native religion sometimes persisted virtually as a secret society, and several Indian religions, old and new, have their followers on present-day reservations.

Far south of the forested north country, Chicago developed rapidly as a transportation hub. The city's prominence as an Indian center is a recent twentieth-century phenomenon, and is at least partially the result of excellent travel facilities. Several hundred Indian people were living in the city in the 1940s when the federal Office of Indian Affairs transferred to Chicago during World War II. The city's Indian population grew rapidly after becoming the first relocation center under a new government program instituted in 1951. The Relocation Program brought Indian people from distant reservations, providing job-training and other services so they could gain permanent employment in the metropolitan area. Results of the program were mixed; some people returned to reservations, but those who remained in the city were joined by friends and relatives, and many moved back and forth between city and reservation communities.

Among the local events of importance to Indian people was the conference held in 1961, through the initiative of Professor Sol Tax of the University of Chicago and the National Congress of American Indians. Five hundred Indian people from across the nation joined in drafting a statement indicating the common goals of present-day American Indians. The statement was presented to President John Kennedy as soon as he

Cloth shoulder bag, beaded with red yarn tassels and red, green, and black silk binding. Chippewa. Cat. 15303
Photo by Ron Testa. neg. 111491

Cloth shoulder bag with beaded yarn tassels (detail), Potawatomi. Cat. 206355
neg 111485

assumed office in 1962. NAES College, established in 1974 with a curriculum designed particularly for Indian students, is now an accredited degree-granting institution. Chicago attracted a large number of Indians again in 1982 for the ceremonies raising a new totem pole at the Field Museum. In 1987, the Webber Resource Center was opened at the Museum to handle the growing number of requests for information about Indian people, particularly in the district around Chicago.

Chicago presently has more than 10,000 Indians living in the metropolitan area, and a long roster of American Indian organizations. Thousands more come every November to attend the annual pow-wow that attracts artists, booksellers, craftsmen, and talented

performers to Navy Pier. The large Indian population in Chicago is not an unusual phenomenon, but is a characteristic of all major cities in the Great Lakes region. The Chicago Indian community includes most of the Indians in Illinois, a state that has no Indian reservations. Yet Michigan, Wisconsin, and Minnesota together have an Indian population above 120,000, with some identifiable Indian representation in every county. Furthermore, an estimated forty to sixty percent of the population living north of Grand Rapids, Michigan; Milwaukee, Wisconsin; and Minneapolis-St. Paul, Minnesota has some degree of Indian ancestry. The first American and immigrant workers entering the north country were generally single men, and many married women of Indian heritage, like the French and British traders, and even missionaries and government agents preceding them.

Representatives of almost all the tribal people living earlier in the western Great Lakes are present today, defying the stereotype of the "vanishing Indian." Wyandot descendants of the seventeenth century Huron refugees live on both sides of the Detroit River, although a large body left Michigan and Ohio for a new reservation in Kansas in 1843. For the past sixty years, the community south of Detroit has sponsored the annual Green Corn Ceremony, with an attendance of about three hundred. Miamis can be found around Peru, Indiana near the large Miami reserve on the Wabash River, subdivided in 1870. Mesquakie survivors of the "Fox Wars" have a reservation at Tama, Iowa on land they originally purchased by selling their own ponies. The Winnebagos in Wisconsin, who have frustrated repeated government attempts at removal, now occupy land in ten counties and a center near Black River Falls. But they remain in close contact with friends and relatives on the tribal reserve in Nebraska.

Potawatomis still live in southwestern Michigan and northern Indiana, the heartland of their original tribal estate. Other Potawatomis live on reservations in Kansas and Oklahoma; Forest County, Wisconsin; and near Escanaba, Michigan. As refugees from the removal program, several thousand also joined Ojibwas on Canadian reserves. The western side of Michigan's Lower Peninsula has a large population of Ottawas, considerably intermixed with Potawatomis and Ojibwas. Many Ottawas had prosperous farms and orchards in the Grand River valley until 1859, when the government conveyed them to poorer lands near Manistee. Ottawas in northwestern Michigan were relatively undisturbed until the railroad reached Petoskey in 1874 and the first real estate office opened.

In central Lower Michigan, Ojibwas from the Saginaw Valley have a reservation at Mount Pleasant. Twenty other Ojibwa reservations are spread across the Upper Peninsula of Michigan and northern Wisconsin and Minnesota, with many more in adjoining Canadian territory. The Ojibwas have carried on lengthy court proceedings to maintain their treaty-guaranteed hunting and fishing rights. In the more northern areas of the Great Lakes, Indian people place greater emphasis on the seasonal pattern of spring sugar-making and fishing, summer gardening and berry-gathering, fall fishing and rice harvesting, and winter hunting.

Contemporary Great Lakes Indians actually follow a variety of economic pursuits. On their reservation at Lac Court Oreille, Wisconsin, Ojibwas operate a national public radio station, as well as commercial cranberry beds. The Menominees, whose reservation near Green Bay is in ancestral territory, manage a large modern lumber mill. Oneidas at Green Bay have recently developed an impressive hotel and conference center near the airport. This group of Oneidas, one of the New York Iroquois tribes, came to Green Bay in 1830 by prior arrangement with the Menominees. The economic status of many reservations is improving since the introduction of still controversial bingo and other games of chance. But the Bureau of Indian Affairs is pleased that funds are being collected to finance housing, scholarships, and health care.

Non-Indians living in the western Great Lakes, still often referred to as "Chemokoman" by Indian people, are beginning to search out their own elusive Indian ancestry and the Indian background of their local communities. Sympathy is increasing for native concepts that stress harmony and balance in the environment and in personal lifestyle. Ideas and beliefs, cumulative through thousand of years of past time, are percolating through to the surface and beginning to permeate contemporary attitudes. **FM**

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Field Museum and Bolivian biologists explore the interior of the Beni Biosphere Reserve, conducting biological inventories on various groups of plants and animals. This large forested area will be managed for long-term conservation goals as part of the "debt for nature" swap arranged by Conservation International. Photo by R. B. Foster.

CONSERVATION OF TROPICAL DIVERSITY

The Field Museum Connection

By Bruce D. Patterson, Associate Curator and Head, Mammals

There is great current interest in what has been termed the "biodiversity crisis." The threatened collapse of biological diversity has attracted wide media coverage the world over, all of it sympathetic to the preservation of diversity. Yet, 20th-century life-styles have intricate interdependencies: one can contribute unwittingly to the destruction of natural diversity simply by purchasing a hamburger or bedroom furniture in Chicago! Obviously, many of society's relationships to tropical diversity are indirect and generally unappreciated, including some critically important ones.

Thus far, media coverage of the diversity crisis has paid only lip service to the crucial roles that natural history museums play in tropical conservation efforts. Far more attention is deserved. Natural history museums are society's only institutions devoted entirely to the study of biological and cultural diversity. Field

Museum is especially important to the science of diversity because it is one of the world's four largest natural history museums and has a principal focus in the tropics. Three of the Museum's four scientific departments (Botany, Geology, and Zoology) focus on biological diversity, its origins, interrelationships, and conservation. Each day, museum scientists discover diversity in nature, document it through collections and study, and disseminate this information to others through scholarly publications and public programs. Many of these contributions are significant to conservation.

I will try here to identify some key relationships between Field Museum's scientific programs and tropical conservation. Although my review is far from comprehensive, it may serve to indicate the range and value of efforts now underway. Readers interested in further information on these programs are encouraged to contact the Museum's Development Office or scientific departments.

The Diversity Crisis: Causes and Consequences

According to current estimates, at least half of all life on earth is threatened with extinction over the next 150 years. The reasons for this calamity do not involve the "death star," *Nemesis*, or climatic catastrophes, which may have caused massive extinctions in the past. Today's extinction wave is the direct result of natural habitats being converted for human use.

Wholesale habitat conversion is proceeding at different rates in different regions. The most alarming and biologically significant form of habitat conversion is taking place in wet tropical forests. Tropical moist forests now cover a scant 6 percent of earth's land area but support at least half of all living species. Most of these forests are in developing countries that have expanding human populations and economies overburdened by debt to creditor nations. The forests represent uninhabited frontiers for new human settlements and expanded agricultural production. Additionally, trade based on forest commodities provides a major source of foreign currencies, which are needed for economic and social development.

Given this political, economic and social context, tropical forests are under relentless exploitation. An estimated 71,000–92,000 sq. km (about 27,000–35,500 sq. mi.) of tropical moist forest lands are denuded each year, and 119,000–200,000 sq. km are seriously degraded. This scale of destruction is hard to imagine and impossible to accept. If you are not already committed to conservation, use your next cross-town trip to imagine the sight of fallen forest giants and wandering, homeless animals stretching from Evanston to Hammond and west to Oak Park—this much devastation happens *each day* in the world's tropical forests. Tropical forests today cover only two-thirds of their extent two or three centuries ago. If deforestation continues at current rates, a fifth of the remaining forests will be cut over by the year 2000 and the last remnant patches would disappear entirely in 150 years. However, growing human populations, especially in the Third World, will probably destroy these habitats much more quickly.

Extinction of species is an inevitable outcome of habitat destruction. Is this all bad? Geological studies tell us that all species eventually go extinct, making room for new forms that constitute evolutionary experiments; further, extinctions have claimed an estimated 99 percent of all species that have appeared through geological time. Even so, today's high standing diversity indicates that, over time, many more new species have been produced than those that disappeared. Much of systematics, the science of biological diversity, focuses on factors affecting the production of new species, the loss of existing ones, and the balance between these opposing rates.

Since its emergence, our species has played an increasingly dominant role as an agent of extinction. At the end of the last Ice Age, when climates were in great flux but human economies were mostly of the hunter-gatherer kind, about two species of birds and two species of mammals went extinct each century. Human hunters may have contributed to the sudden extinctions of large vertebrates (the "overkill hypothesis" of Paul Martin at the University of Arizona), but rapid climatic changes may also have been involved in the disappearance of these forms. Between 1600 and 1900 AD, when climates were stable but human technologies were considerably more developed, extinction rates increased ten-fold: roughly 10 mammal species and 27 bird species went extinct each century. Most extinctions during this period resulted from direct human persecution—Steller's sea cows, Tasmanian marsupial wolves, passenger pigeons, and dodo birds would still exist today but for humans. A host of other species only narrowly escaped extinction (perhaps not for long), including whales, bison, and cranes.

Today, human-caused extinctions are rapidly accelerating and now vastly exceed the origination of new species by evolution. Direct persecution of some

species continues, despite protective legislation, but these effects are dwarfed by habitat destruction. Habitat destruction causes an indiscriminate loss of species throughout an ecosystem, not only the meaty, attractive, or threatening targets of human exploitation. All species need a place to live, and many exhibit adaptations that intricately bind them to specific habitats or to particular biological associations within habitats (*e.g.*, many forest trees and the bats or rodents that pollinate their flowers or disperse their seeds). When the habitat disappears, so do all the species that inhabit it. Scientists estimate that rates of extinction caused by habitat destruction are at least a thousand times greater than normal "background" extinctions. Daniel Simberloff of Florida State University predicts that as many as two-thirds of all tropical species will go extinct through deforestation over the next 150 years.

The disappearance of this diversity has unfathomable consequences for human beings. Tropical diversity represents a storehouse of potential human applications, but one being looted and vandalized by uncontrolled development. Few people realize that almost all of the world's agriculture involves only 25 species of plants (one ten-thousandth of the species we've identified). Nor do many appreciate the constant threat to agricultural production or human health posed by newly appearing pathogens and parasites. Fewer still are aware that many "wonder drugs" of modern medicine (including penicillin, atropine, and digitalis, among many others) are compounds "invented" and produced by species in nature. Our daily reliance on biological materials and understanding will increase dramatically over the next century. As human populations treble (to an estimated 11 billion) by the year 2100, food produc-

Deforestation in the upper Amazon Basin of Rondônia, Brazil, termed "an environmental holocaust" by a recent *National Geographic* article. Field Museum mammalogists and ornithologists conducted biological inventories at a nearby dam site on the Rio Ji-Paraná in late 1986. Their work provides a baseline against which future degradation can be assessed, as well as information to mitigate the effects of construction. Photo by B. D. Patterson.

tion and disease prevention must grow in parallel. We cannot guess the possible agricultural, medical, or ecological benefits that disappearing tropical species could offer a needy mankind.

Field Museum and Tropical Diversity

The majority of forms at immediate risk in the diversity crisis inhabit moist tropical forests. Although many of these forests have never been studied, existing information suggests that most tropical species have yet to be discovered: tropical samples of many groups of organisms contain more new species than previously described forms. Such ratios indicate that from 3 to 28 million species in tropical forests await scientific discovery and description. The magnitude of this scientific challenge may be dimly appreciated when one considers that, throughout the Age of Exploration and Discovery (1760–present), scientists described about 1.7 million species.

The scientific community is ill-equipped to address this profound deficiency in our biological understanding. Edward O. Wilson of Harvard University estimates that fewer than 1,500 scientists worldwide are trained in the systematics of tropical organisms (or about one scientist per 2,000–18,700 species). At present, less than 1 percent of known species is under scientific investigation. Exacerbating this problem, available funds for systematic research are minimal: *annual* allocations in the United States could not support *a single working day* in the "exploratory phase" of Star Wars development. Consequently, the numbers of scientists attracted to careers in systematics and training programs for them have declined at the very time that need is greatest.

Field Museum is one of the world's four largest centers of systematic biology. Each scientist in its departments of Botany and Zoology studies tropical plants and animals, contributing in different ways to knowledge of tropical diversity. It goes without saying that the patterns and processes affecting natural diversity must be studied if we are to devise effective strategies for conserving it. Areas in which museum staff contribute directly to tropical conservation efforts are sketched below, but space limitations make this very incomplete.

Inventories of Unknown Biotas

Priorities are essential for effective conservation because the entire globe is under seige and there are inadequate funds to protect all or even much of it. Most conservationists focus on saving habitats rather than individual species—because organisms are intricately interrelated, functioning ecosystems must be preserved in order to retain all the resources, checks, and balances required for the stable persistence of individual species. Various criteria are used to decide which habitats are most important to conserve, but the number of species inhabiting an area and their uniqueness (or endemism) rank high. This information can only come from biological inventories of the species occurring there: the richer the biota and the greater its distinctiveness, the higher the value of preserving its habitat.

Applying this simple rule-of-thumb in the world's tropics is a surprisingly difficult task. For one thing, identifying species in nature isn't easy. We can all recognize hummingbirds at our bird-feeders, but few can recognize the 300+ species that occur in the New World tropics. Remember, there are no field guides to most tropical organisms because they have never been studied, and this information doesn't exist even in the largest technical libraries. In addition, many species of organisms are distinguished by such subtle differences that chromosomal, genetic, acoustic, microscopic, and other kinds of characters must be examined by specialists before the species can be identified.

As a group, museum curators surpass all other scientists in their ability to identify organisms. This key ability rests on extensive training and resources. After nearly a century of active work in tropical systematics, Field Museum maintains enormous reference collections that are broadly representative and comprehensive. As examples, all continents and most countries are represented in most collections; in addition, 98 percent of all living families of mammals and 99 percent of all bird families are represented at Field Museum. The collections are also rich in "type" specimens, which have special value in making identifications. Comprehensive libraries of scientific literature are also crucial—Field Museum's is one of the best, with over 235,000 volumes in natural history dating back to the bestiaries and herbals of the Middle Ages.

Because most tropical regions are poorly known, inventories there typically uncover species new to science. These must first be distinguished from known forms and then scientifically described. Only systematists are qualified to describe new forms, according each a unique name. This process provides an essential foundation for every other branch of biological science: ecologists and physiologists cannot accurately

record and report their work without a name to associate their observations or the means to distinguish that form from others. Virtually all museum scientists describe new organisms, expediting the work of other biologists through the publication of floras, faunas, and identification keys. For example, malacologist Alan Solem has described more than 250 species of land snails from Australia, representing at least a quarter of all the species known from that continent.

For nearly all groups, inventories are impossible without making new collections. Collections of specimens represent the primary, enduring documentation of an inventory—study and analysis of collections leads to identification and description, in addition to enabling a host of other biological studies. Gathering comprehensive collections in the field is another forte of museum scientists—many groups are so inconspicuous that only an expert is able to detect their presence at a site. Detailed knowledge of the distribution and natural history of species enable museum scientists to record plants and animals that are overlooked by other kinds of field biologists.

The scientific community constantly reviews its own priorities for conservation, and these guide patterns of funding and publication. There is now a consensus that detailed ecological studies contribute most to protecting temperate-zone species. This is only possible because temperate-zone organisms can be easily identified and their basic biology is relatively well known. However, focused collecting surveys at a variety of sites provide the most "bang-for-the-buck" in the unstudied tropics. They yield materials that permit diversity to be discovered and described; they identify habitats with exceptionally high diversity; and they indicate (by numbers of species shared) the distinctiveness of habitats from one another. Each of these is fundamental to conservation planning.

Rabor's tube-nosed bat (*Nyctimene rabori*) was collected by mammalogist Larry Heaney in 1981 during an inventory of Negros Island, Philippines. This animal was recognized and described as a new fruit-bat species in 1984—by 1987, it had become severely endangered by deforestation. Photo by P D Heideman

Definition of Biogeographic Regions

Protecting areas that are rich in species does not ensure that the goals of conservation will be met. Many areas, such as the Galápagos Islands or Hawaii, support relatively few species, yet these may be so distinctive that their preservation is a high priority. Through coordinated inventories of sites throughout a given geographic region, museum scientists help to identify and delimit areas that are internally similar in terms of their biotas while differing from all other areas. Conservationists need this information to ensure that each biogeographic region, with its unique species and resources, contains a sufficient number of protected sites.

Museum scientists work at different scales in such regional studies. Some study the biotas of far-flung continents, while others concentrate on those of adjacent communities. All begin their work from a specific site inventory that identified large fractions of unique species. Working outwards from this point of knowledge, researchers sample adjacent areas to determine the geographic limits of these regions. General collections, a hallmark of museum research, are essential to such studies because they document a large segment of a region's biota and hence characterize its general features. In addition, systematic collections are needed to determine a biota's affinities or evolutionary histories and

this is also important to conservation. The conservation value of Darwin's finches derives in no small part from the substantial evolutionary differences that separate these Galápagos Island birds from continental forms.

Species of Special Concern

Biologists maintain "Red Books" in which the world's endangered and threatened species in all taxonomic groups are listed. Rates of current habitat destruction are such that these compilations can never be up-to-date—by the time they are compiled and published, many more species are known to be endangered. In addition, such books cannot be more than indicative, given the large proportion of biological species still unknown to science. Many unknown species are undoubtedly imperiled, but detailed knowledge is required to demonstrate that a species is imperiled. Jared Diamond of the University of California, Los Angeles has suggested that a more scientifically defensible endeavor would be to publish "Green Books," enumerating those (relatively few) species that are known to be secure.

Museum scientists generally focus on ecosystem-level conservation but also make important contributions to efforts to conserve particular species. These contributions rest on broad training. Through study of all aspects of natural history, museum scientists commonly assemble the foundations of ecological and behavioral information on species of special concern. This information is essential to management of natural populations. Recent Field Museum studies on diets of harpy eagles, abundance and habitats of Chilean shrew-opossums, geographic ranges of New World monkeys, and ecology of Asian flying lizards serve as examples. These contributions can have value to conservation which transcends management programs focused on single species—individual species such as harpy eagles, spectacled bears, and lion tamarins can serve as "flagships" for conservation efforts, igniting public interest and support.

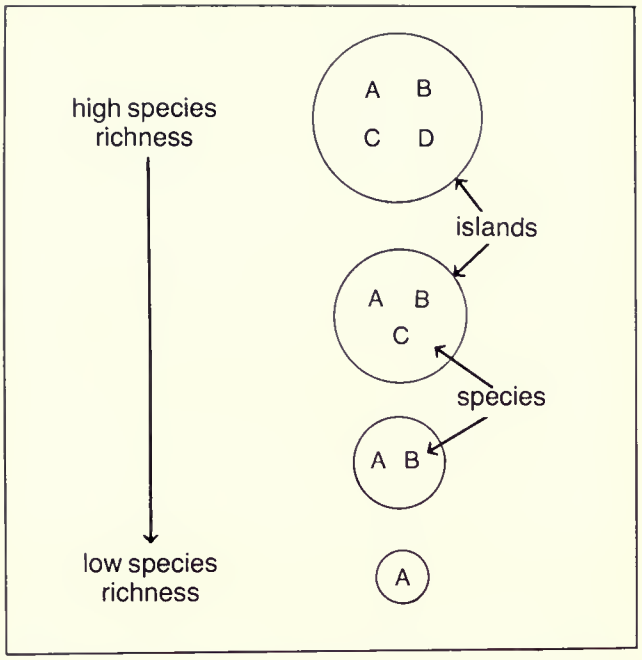
Conceptual Studies in Conservation

Conceptual studies are key to making conservation biology a predictive and powerful science. It is impossible to study individually all the areas that need preservation, given shortages of money, manpower, and time. By assembling information on general patterns and processes, scientists can make inferences that permit informed conservation decisions in a timely and cost-effective fashion.

Discovered and described by Field Museum zoologist W. H. Osgood during the Marshall Field Chilean Expedition of 1922-23, the Chilean shrew-opossum (*Rhyncholestes raphanurus*) remained virtually unknown for 60 years. In 1977, Chilean researchers declared it "the rarest mammal in Chile." During an inventory of Parque Nacional Vicente Perez Rosales, mammalogist Bruce Patterson found that this form was abundant and occupied a variety of habitats, indicating its current status as secure. Photo by B. D. Patterson.

Most predictions of species loss in the wake of tropical deforestation are based on an analogy between nature reserves and islands. Like islands, nature preserves are often surrounded by inhospitable areas and isolated from sources of colonization. By studying island biology, museum researchers have identified some general patterns of natural distribution and abundance that have direct conservation implications. Working in the Philippines, mammalogist Larry Heaney has studied how extinction rates change over time. Extinction rates are apparently very high soon after islands become isolated and subsequently decrease to minor or insignificant levels. Thus, fragmentation of forests through cutting should produce rapid extinctions of many species, after which the communities will stabilize.

Small islands have long been known to support impoverished faunas, but scientists have generally regarded the species comprising them as being random samples of a given biota. In 1985, I noted that the species found on small islands were also present on larger islands, but other species are never present on small islands. This pattern characterizes mammal and bird fauna in several archipelagos. The significance of such patterns of species richness and composition is clear:



A schematic view of "nested subsets," a pattern of distribution shown by mammals and birds on islands. When islands are arranged in order of species richness, it is obvious that smaller islands support fewer species than large islands and that these are the *same* species, not different ones. Only the largest islands (or island-like preserves) support rare or narrowly distributed species such as "C" or "D." Figure by B. D. Patterson.

only the largest isolated preserves will sustain populations of most species. In addition, the rare, narrowly distributed species that need special protection occur only on the largest islands.

Other conceptual studies underway at the Museum do not employ island analogies; instead, they address basic mechanisms of community ecology that are useful in management. Herpetologist Robert Inger is studying the dynamics of amphibian and reptile communities in Bornean rainforests, and his 30 years of fieldwork give him unique perspectives on their stability over time. By comparing community patterns in intact forests and forests subjected to cutting at various times in the past, Inger is determining the susceptibility of these communities to deforestation. In the process, he is acquiring important information on the vulnerability of particular species to disturbance.

Coordination with Resource Managers

Direct coordination of scientific studies with resource managers ensures that information on tropical species and habitats is quickly passed from the volumes of research libraries to conservation action. The nature of these interactions depends on the specific needs and objectives of a management authority and the Field Museum resource that is called upon to address it.

Field Museum's collections of specimens resemble immense libraries that chronicle the occurrence of myriad species at particular places and times. The collections are maintained in excellent condition, being continually curated (reidentified, relabelled, reorganized) according to the current state of knowledge. Data from several Field Museum collections are now fully computerized, and funding for data base projects in other collections is being sought. Collection information can now be easily shared with managers and planners who seek to inventory imperiled biotas or to determine the range and status of individual species. Because the collections have been amassed over the last 100 years, they are especially useful in assessing the effects of environmental degradation during the 20th century. As computer networking develops, Museum data bases will contribute significantly to a global heritage program.

Field Museum researchers are also called upon to share their personal knowledge and expertise on the floras and faunas of specific regions, entire countries, and even continents, as well as the specific biologies of endangered species. These collaborations are essential for the development of national inventories and for meaningful "survival plans" for endangered forms. Recent consultations with the Nature Conservancy on distributions of South American mammals and with IUCN* editors of *Red Data Book: Aves* serve as examples.

Frequently, coordination with resource managers involves fieldwork. During the last decade, Field Museum personnel have conducted benchmark surveys in many national parks and reserves throughout the world's tropics. In most cases, these studies generated the first inventories of species that are protected by the parks. Once the richness of these areas is documented, it is easier for managers to justify additional funds to maintain the parks and to devise specific measures for their protection. To date, park surveys have been conducted in Costa Rica, Venezuela, Brazil, Peru, Bolivia, Chile, Philippines, Borneo, and China. Plans call for additional surveys of parks in Mexico, Guatemala, Brazil, Peru, Bolivia, Uganda, Madagascar, and Borneo in the near future.

Studies of distribution and abundance at particu-

*International Union for Conservation of Nature and Natural Resources

As part of the ongoing systematic and conservation research on the fishes of the Orinoco Basin in Venezuela, ichthyologist Barry Chernoff, along with colleagues and students from the Universidad Central de Venezuela, inventories rivers and flooded savannahs on the Guyana Shield. They are searching for areas used by fishes for reproduction and as nurseries. To conserve these fishes, areas must be set aside where both younger and older fishes flourish.
Photo by R.M. Peck

lar sites or involving particular species may also be undertaken as part of more extensive research programs. Museum personnel have participated in ecological impact studies at future dam sites in Borneo and Brazil. These studies yield unique information on natural biotas before construction begins, providing benchmark data needed to monitor subsequent environmental changes. Further, they oftén identify measures that can minimize the negative impact of construction (see "Paradise Being Lost" by John W. Fitzpatrick, Jan., 1988 *Bulletin*). Studies on the distribution and population ecology of species harvested for food, such as fishes of the Orinoco River system studied by Barry Chernoff or Brazilian rainforest tortoises studied by Debby Moskovits, can be used to gauge whether natural resources are being used at sustainable levels.

The broad spectrum of mutual interests and productive interactions between museum scientists and conservationists recently led to a landmark event. In September 1988, Field Museum formed a cooperative partnership with Washington-based Conservation International (CI). CI is one of the most widely acclaimed and accomplished organizations involved in

Biologists sorting leaf-litter in the course of inventorying amphibians and reptiles in Borneo. Specialized techniques are needed to adequately sample tropical diversity and to provide data for rigorous analyses of distribution and abundance.
Photo by R. F. Inger.

conservation of Neotropical diversity. Coordination of missions at this level has facilitated the effective sharing of resources and talents and heightened the conservation impact of museum-based programs. Through this agreement, Field Museum's unique expertise and resources are being skillfully coordinated with a variety of Latin American institutions, organizations and needs. CI personnel arranged the highly publicized debt-for-conservation swap that enabled Bolivia to protect large tracts of its tropical rainforests; a large-scale biological inventory of this reserve currently involves Field Museum researcher Robin Foster. Another early product of this partnership is a book jointly sponsored by CI and Field Museum (now in preparation) on the distribution and ecology of South American birds, the world's richest avifauna.

Training and Education of Conservation Biologists

Spectacular recent advances in molecular biology have led many universities and other research institutions to focus increasingly on cells and molecules. Few institutions remain dedicated to "whole organism" biology, which heralded the fields of evolution, ecology, and genetics as we know them today. Natural history museums remain bastions of integrated biology—although molecular techniques are increasingly used in systematic research, an essential focus on organisms and populations remains. Museums are associated with most vigorous programs in evolutionary biology.

Peruvian Victor Pacheco came to Field Museum for education and training in 1986. Here doing fieldwork in Monteseco, northern Peru, he is surrounded by local schoolchildren captivated by the thought that their local bat fauna warrants study by Chicago-based researchers. Pacheco received an M.S. degree from the University of Illinois, Chicago in December; on returning to Peru, he began training and advising his own students at San Marcos University in Lima.
Photo by B. D. Patterson.

Moreover, they are indispensable for training the future systematists we must rely on to identify and document the world's diversity.

No free-standing museum maintains better, more productive associations with neighboring universities than Field Museum. Individual Field Museum biologists have faculty appointments at the University of Chicago, University of Illinois, Chicago, Northwestern University, and Northern Illinois University, serving on graduate student committees at these institutions and others. Field Museum researchers comprise about a third of the acclaimed Committee on Evolutionary Biology, an interdepartmental degree-granting body of the University of Chicago. Perhaps a quarter of the graduate students enrolled in this illustrious program are now studying at Field Museum, many in areas related to conservation.

In the course of conducting their own fieldwork in the tropics, Museum researchers routinely teach collecting and data-gathering activities to local students and technicians. This training continues after fieldwork is completed, as specimens are prepared, sorted, identified, and described, often in collaboration. A variety of accomplished scientists in tropical countries received their first exposure to the skills and techniques of biological inventories in association with Field Museum collecting parties. This expanding pool of persons able to conduct tropical inventories and train other biologists has immeasurable effects on conservation.

Field Museum's role in training biologists in conservation is not limited to area universities or fieldwork. Museum funds in support of international scholarship enable a host of Third World researchers engaged in independent projects to study Field Museum collections, use its libraries, and interact with its staff. Grant recipients gain valuable observations and experience that would otherwise be out of reach economically. Critically, this program has a snowballing effect as foreign scholars return home to share new experiences, techniques, and perspectives with their own colleagues and students. Field Museum is actively working to expand this training-education program.

Development of Public Awareness

Ultimately, the problems of tropical deforestation are driven by social, political, and economic factors. It would be shortsighted to address conservation problems without attending to these ultimate causes. A variety of avenues are open to museum scientists, but the

The Pantiacolla of southeastern Peru, a ridge separated from Andean foothills by the Río Alto Madre de Dios. Ornithologists John Fitzpatrick and David Willard have assembled a complete inventory of birds at this site, one of the world's richest. In the process, they have described new species that are restricted to this isolated range and detailed the elevational ranges of the entire avifauna. This information is critical to understanding dynamics that shape these avian communities. Photo by J W Fitzpatrick

most important of these is public education.

Once systematic studies of a group or a region have been completed, this information can be presented readily to the public. Popular accounts often have tremendous impact on the general public by making complex biotas generally accessible to nonspecialists. Clifford Pope's *Reptiles of China* and Robert Inger's *The Fresh-water Fishes of North Borneo* and *The Amphibia of Borneo* are enduring examples of such work. Through fostering an appreciation of a region's natural resources and providing keys for the identification of its species, these works enable the public to observe and study nature.

Through its public programs (exhibits and public education), the Museum also communicates the findings of its scientists on the nature of diversity and its interdependencies. Public lectures, tours, and popular articles by the scientists themselves are valuable adjuncts to these efforts, as is technical consultation on public programs of other communications media and organizations. Together, these efforts shape the value systems of people, both in this country and abroad. In the final analysis, all development decisions involve weighing the value of conserved diversity versus development of natural resources for some other end.

Conclusions

Scientific progress takes a very predictable historical course. One first identifies the variables that are involved in a phenomenon, and then evaluates them singly or in concert with others; ultimately, one derives predictions of their specific effects. Tropical biology is still in its infancy. Only recently have we discovered that some high-calorie seeds not eaten by modern consumers are actually vestiges of prehistoric ecologies, that hunting behavior of bats can affect the mating calls of frogs, and that mice play a key role in growth

Field Museum researcher Mike Dillon collecting a new and very unusual bromelid (*Tillandsia sp.*) with a botanical "lasso." This plant is known from a single canyon in the Atacama Desert of northern Chile, where its rocky purchases protect it from hungry goats.
Courtesy M. O. Dillon.

and regeneration of some rainforests. We need to identify the players and we must do it quickly, before they are forever lost.

Because systematics is the mother of all other biological sciences, furnishing the basic framework for their observations, systematists will be at the vanguard of this expanding tropical data base. We sorely need inventories of many more tropical sites, to document patterns of species richness, to identify "hot spots" of diversity, and to delineate regions of endemism. We must also characterize previously unknown species, determine their derivations, and uncover their ecologies. While lacking the romance of rainforest exploration, there is no other way to document natural diversity in a manner useful to science. We need to revisit areas that have been sampled previously to determine the stability of ecological relationships and the effects of environmental perturbations between sampling periods. We need to train new researchers, especially biologists in the Third World who are in the frontlines of the battle to save the globe's diversity.

In this piece, I have tried to explore the integral relationship between the study of life's diversity and its conservation. The two fields are associated both scientifically and philosophically. The idea that evolutionary biology has left an indelible mark on conservation isn't new. Darwin's conclusion to *The Origin of Species*, published 130 years ago, bears this out:

It is interesting to contemplate a tangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us. . . . There is grandeur in this view of life, with its several powers, having been originally breathed by the Creator into a few forms or into one; and that, whilst this planet has gone cycling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved.

Darwin considered this to be the scientific challenge of his evolutionary theory, for humans to recognize the fundamental unity of life and to take our own place in nature, with wonder not ignominy. Tropical deforestation is now transforming the grandeur of this view into horror—myriad lineages around us are ending forever at the hands of human wantonness and greed. Darwin's placid reflection on life's continuity, with its reference to future evolution, is haunting in today's context. It is a vision that can no longer be ignored. **FM**

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FIELD MUSEUM TOURS

ENGLISH HOMES and GARDENS

July 4-15

Tuesday, July 4: Tour members will be met by the local tour director at London Heathrow, Terminal 4 (British Airways). Board a luxury coach for the short journey to Canterbury, where we will be met by our hostesses and driven to their homes. Lunch with the hostesses, followed by a restful afternoon and dinner with hostesses this evening.

Wednesday, July 5: Sandwich Nature Reserve & Canterbury. First to Sandwich Bay Nature Reserve for a conducted coastline walk to see the wildflowers there. Stop at a pub for lunch, before continuing on to Canterbury for a private tour of this great cathedral, for those who wish. Followed by free time to wander or explore before returning to hostesses in the late afternoon. Dinner this evening in a private home.

Thursday, July 6: Ladham and Great Dixter. First a short drive to the West, towards the county of Sussex to visit Ladham, the home of Betty, Lady Jessel, who will personally conduct a tour of her gardens. A pub lunch in Goudhurst, followed by another short journey to Great Dixter, a small gem of a house, built in about 1450, which now has a most interesting garden, created and maintained by the author and broadcaster, Christopher Lloyd. The grounds include areas of native wildflowers and grasses. Return to hostesses and later on dine in a private home.

Friday, July 7: Leeds Castle and Sissinghurst. First a private visit to Leeds Castle, including its gardens and aviary, which was described by Lord Conway as "the loveliest Castle in the world." Drive on through the Kent countryside to Sissinghurst Castle, for lunch in its restaurant. In the afternoon, visit its well-known, and very beautiful gardens, created by Vita Sackville-West and her husband, Harold Nicholson. Dine this night with hostesses.

Saturday, July 8: Heaselands. Goodbye to Canterbury hostesses and first drive to Heaselands, the home of Mrs. J. N. Kleinwort, for a private tour of her seventeen-acre garden, conducted by her head gardener. This outstanding garden was created by Mrs. Kleinwort and her late husband over a period of thirty years. A pub lunch close to Sheffield Park, before travelling on North and West to the Cotswolds to meet, and later dine, with hostesses there.

Sunday, July 9: The Cotswolds. In the morning, an opportunity for those who wish, to worship before luncheoning with hostesses. In the afternoon, visit Hidcote, a lovely garden created by the American horticulturalist, Major Lawrence Johnston. Hidcote is a series of small gardens, surrounded by walls and hedges, contained within the whole. Dine this evening in a private home.

Monday, July 10: Oxford and Blenheim. In the morning we visit Oxford for a tour, first of its Botanic Gardens, followed by a general tour of Oxford colleges, for those who wish. Lunch in a private home. In the afternoon visit Blenheim Palace, home of the 11th Duke of Malborough, and birthplace of Sir Winston Churchill. Dinner this evening will be with hostesses.

Tuesday, July 11: Travel to Bath. Farewell to Cotswold hostesses, and board the coach for a short drive South to Barnesley. Here, the well-known gardening author Rosemary Verey will personally conduct a tour of her outstanding gardens, which surround her delightful South Cotswold house. Lunch in the local pub, and in the afternoon, continue to Bowood, the family home of the Earl of Shelburne, to see both the house and its gardens. The Robert Adam Diolетian houses magnificent rooms and a 5,000-volume library. In the gardens the collections of trees and shrubs include 153 species and over 900 varieties, all of which are labelled. Later in the afternoon, continue to the Bath area to meet, and later dine, with Bath hostesses.

Wednesday, July 12: Bath. In Bath we tour this elegant Georgian city with its outstanding crescents, not the least of which is the Royal Crescent, claimed to be the finest in Europe. Lunch in a restaurant in town. In the afternoon, a choice either to stay in Bath to shop and explore, or to visit Wells for a private tour of its

Sissinghurst Castle Garden © copyright British Tourist Authority

Leeds Castle, Kent
© copyright British Tourist Authority

eight-hundred-year-old cathedral. Return to hostesses in the late afternoon, and later this evening, dine in a private home.

Thursday, July 13: Wilton and Heale. We drive south down the lovely Wylie Valley to Wilton House, just North of Salisbury. Visit the home of the 17th Earl of Pembroke to see its magnificent State Apartments, including the famous Double Cube Rooms, and one of the finest art collections in Europe. The gardens contain an interesting variety of trees, including the Golden Oak tree and giant Cedars of Lebanon. Roses are a feature and Lord Pembroke recently opened an Old Rose Garden. After a pub lunch, visit Heale House, the home of Mrs. David Rash, with its superb five-acre garden. Shrub roses and perennials are a prominent feature, together with Japanese tea house and magnolias. Return to hostesses in the late afternoon to dine with them.

Friday, July 14: Travel to London. Goodbye to Bath hostesses and drive east to the Royal Horticultural Society Gardens at Wisley. These gardens, which extend over 470 acres, are "working gardens," with every plant and flower or shrub labelled. They are a joy for both the serious and amateur gardener, or horticulturalist. Lunch in the garden's restaurant. In mid-afternoon, continue into central London and check into the Naval and Military Club, located in the heart of London's West End, where we will be the guests of Lt. Colonel Ronnie Adam. He will host a Welcome to London Reception in the Club for Tour Members this evening. Dinner by own arrangements.

Saturday, July 15. A free day for Tour Members to pursue their own interests, either shopping or sight-seeing. The booklet in the personal folders given to each guest on arrival in England list places of interest in London, how to get there, and times of opening. The tour director will assist in putting together the day's program, for those who wish. Lunch and dinner by own arrangements.

Sunday, July 16. Those returning home this day will be escorted to the departure airport by the tour director for the return flight home. Additional night's accommodation may be arranged at the Naval and Military Club for those wishing to stay on longer in London, subject to availability.

As you see, we will visit a number of outstanding gardens, and your enjoyment will be enhanced by the leadership of Bertram G. Woodland, a former curator at Field Museum, who will accompany the group throughout the tour. Additionally, the opportunity to stay in private homes and share the hospitality of the English hostesses, and the overnight stay at the Naval and Military Club should offer some delightful and interesting experiences. We hope you will join us for this very special tour.

PRICE: $3,575. (includes $100 tax-deductible contribution to Field Museum).

Christchurch Gate leading to Canterbury Cathedral © copyright British Tourist Authority

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For reservations, call or write Dorothy Roder (322-8862), Tours Manager, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Il 60605

Field Museum of Natural History
Membership Department
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605-2499

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FIELD MUSEUM OF NATURAL HISTORY BULLETIN

April 1989

April: Family Month at Field Museum!
"Families at Work" Exhibit Formally Opens.
Dr. Benjamin Spock on Parenting, Saturday, April 8.

Field Museum of Natural History Bulletin

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COVER

Portion of the new "Families at Work" exhibit, formally opened this month. See pp. 12-17. Photo by Ron Testa and Diane Alexander White n85228

Volunteer at Field Museum

Learn something new or share your expertise—a wide variety of challenging and rewarding volunteer opportunities for either weekdays or weekends are currently available. Please call the Volunteer Coordinator at (312) 922-9410, extension 360, for more information.

MEMBERS' NIGHT

Friday, May 5
5:00-10:00pm

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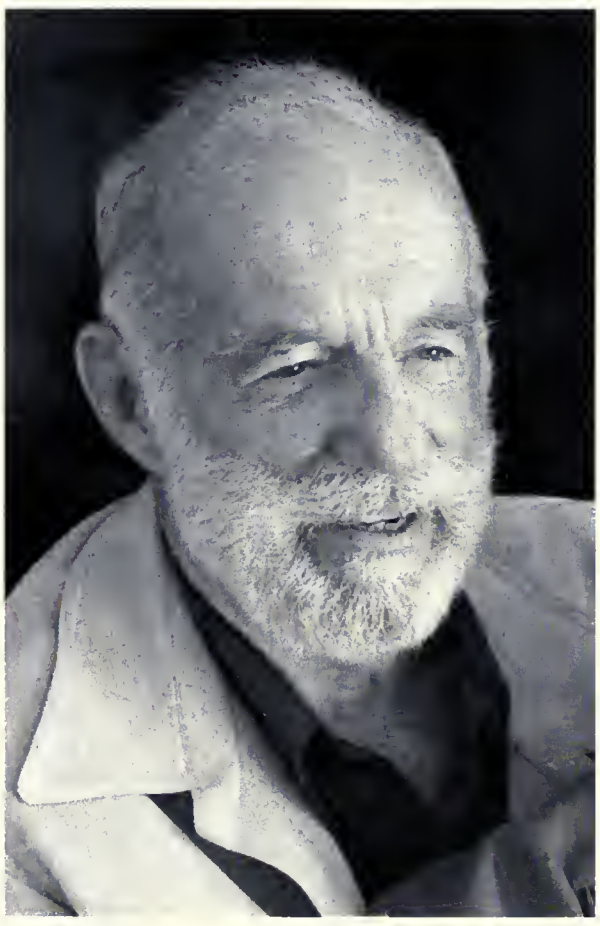
EVENTS

Dr. Spock on Parenting

Dr. Benjamin Spock
Saturday, April 8, 2:00pm



Dr. Benjamin Spock's name has become synonymous with parenting. Perhaps the most eminent pediatrician and child psychiatrist in the world, Dr. Spock has been studying and writing about children for over 40 years.

Join Dr. Spock as he expresses his views on the "strange mixture of stress and joys" of parenting. He recognizes that today's parents need guidance beyond their concerns for the physical well-being of their children. He feels the new American family needs new guideposts. From the universal concerns of all parents to the contemporary problems of the '80s, Dr. Spock shares his wisdom and experience. In an era when simply defining a parent can be a complex matter, gain some sensible insights from America's most trusted child care expert.

LL89201 Dr. Spock on Parenting
Tickets: $10 ($8 members)

Please use the coupon p. 4

Afternoon Films

Thursdays in April
1:30pm, Lecture Hall I

April 6 *Audubon*
1977. 50 min. Color

A fascinating film that traces the travels of John J. Audubon (1785-1851) throughout Europe and North America. Although Audubon named, classified, and wrote about birds, he is probably best known as an artist. The minute detail he portrayed as he painted birds in their natural settings can be seen in film scenes taken from his most famous book, *The Birds of America.*

April 13 *Xian: Cities in China*
1980. 60 min. Color

This captivating film unlocks many of the secrets of Xian, the ancient imperial city of China. This city has many archaeological treasures including the life-size pottery army of the emperor Qin.

April 20 *Mzima: Portrait of A Spring*
1978. 53 min. Color

The hippopotamus is the central character in this examination of African wildlife at Kenya's Mzima, where 50 million gallons of water flow daily. Nature maintains a delicate balance between animals and the food supply at the spring. The survival of the hippopotamus ensures the existence of other species at the spring such as elephants, baboons, kingfishers, butterflies, spiders, fish, and frogs.

April 27 *The Tribal Eye: Sweat of the Sun*
1980. 50 min. Color

Little of the golden hoard of the Aztecs and the Incas escaped the brutal pillaging of the Spanish conquistadores. In *Sweat of The Sun,* David Attenborough examines some of the most important pre-Columbian objects that eluded European smelting furnaces and describes how these objects were used by priests of the Aztec and Inca cultures in practical and ritual fashion.

Films are free and tickets are not required.

EVENTS

PROJECT!

A Musical Documentary
Free Street Theater

Friday, April 21, 7:00pm
Saturday, April 22, 2:00pm, 7:00pm
Sunday, April 23, 2:00pm

Free Street Theater performs April 21, 22, 23

PROJECT!, a musical documentary, explores the humanity behind the negative headlines of the troubled Cabrini-Green neighborhood. With a background of lively dance and song, children and adults from Cabrini-Green tell their story. Through the use of 70 television sets, stacked to suggest the high-rises, residents talk about daily life in videotaped interviews, interwoven between live dance and vocal numbers.

What makes PROJECT! special? For one, these are not actors playing parts. These are Cabrini-Green residents playing themselves, telling of daily life in this all-black ghetto, from their own personal experience. Their ages range from 8 to 48 and their story is real.

Tickets: $12 ($10 members); $7 children (12 and under).

Special note: Be sure to indicate time of performance requested on registration form, p. 4.

Registration

Be sure to complete all requested information on this registration application. Registrations are confirmed by mail. For registrations received less than one week before the program date, confirmations are held at the West Door for pick-up one hour before the program begins. Phone registrations are accepted using Visa/MasterCard/AMX/Discover. Please call (312) 322-8854 to register. The minimum amount for credit cards is $15.00. For further registration information, consult the April/May Adult, Children, and Family Program Brochure.

Return complete registration with a self-addressed stamped envelope to:

Field Museum of Natural History
Department of Education, Program Registration
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605-2497

Program Number	Program	#Child	#Member	#Nonmember	Total Amount
LL89201	Dr. Spock on Parenting				
LL89202	Bug Basics				
LL89203	Bug Basics-Child				
	PROJECT! Friday, April 21, 7:00 pm				
	PROJECT! Saturday, April 22, 2:00 pm				
	PROJECT! Saturday, April 22, 7:00 pm				
	PROJECT! Sunday, April 23, 2:00 pm				
				total	

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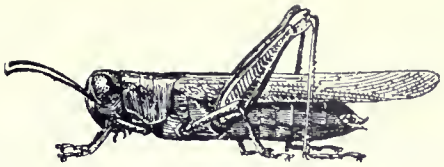
EVENTS



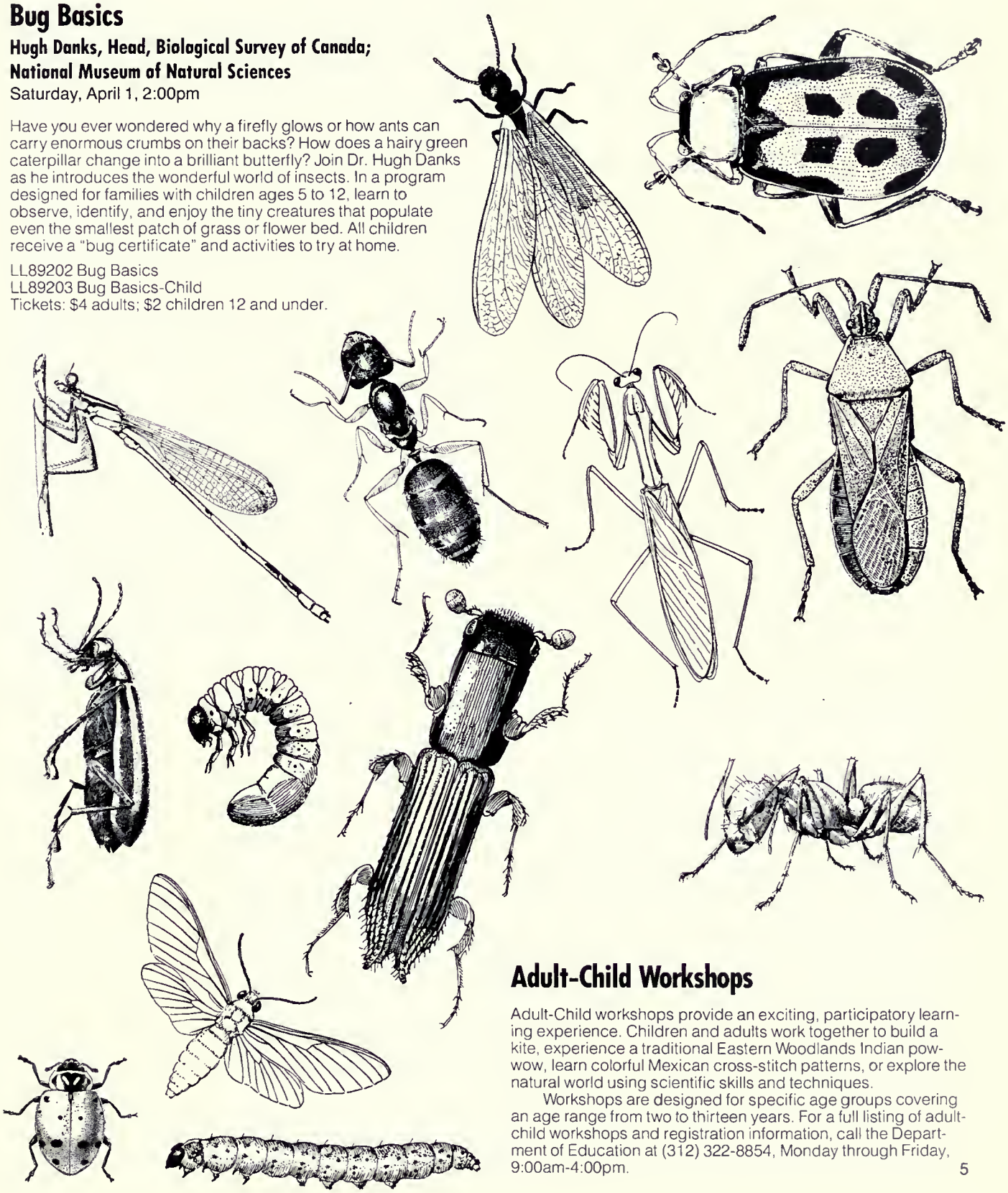
Bug Basics

Hugh Danks, Head, Biological Survey of Canada; National Museum of Natural Sciences

Saturday, April 1, 2:00pm

Have you ever wondered why a firefly glows or how ants can carry enormous crumbs on their backs? How does a hairy green caterpillar change into a brilliant butterfly? Join Dr. Hugh Danks as he introduces the wonderful world of insects. In a program designed for families with children ages 5 to 12, learn to observe, identify, and enjoy the tiny creatures that populate even the smallest patch of grass or flower bed. All children receive a "bug certificate" and activities to try at home.

LL89202 Bug Basics
LL89203 Bug Basics-Child
Tickets: $4 adults; $2 children 12 and under.



Adult-Child Workshops

Adult-Child workshops provide an exciting, participatory learning experience. Children and adults work together to build a kite, experience a traditional Eastern Woodlands Indian powwow, learn colorful Mexican cross-stitch patterns, or explore the natural world using scientific skills and techniques.

Workshops are designed for specific age groups covering an age range from two to thirteen years. For a full listing of adult-child workshops and registration information, call the Department of Education at (312) 322-8854, Monday through Friday, 9:00am-4:00pm.

FIELD BRIEFS

Thomas R. Sanders, Vice President Of Development, Retires

Thomas R. Sanders, vice president for Development of Field Museum, retired on January 31, after having served as chief development officer for the Museum for almost twenty years. In a profession known, among other things, for a tradition of transiency in tenure, that tenure, alone, is cause for notice. But Tom Sanders did far more than just put in two decades of service. More than any other person, he is the leader and the craftsman of, and the glue that held together, Field Museum's fund-raising effort over that period.

Tom Sanders joined the Museum staff in the fall of 1969. He inherited little more than an embryonic fund-raising program and financial needs of awesome proportions. In typical Sanders fashion, he went to work—planning, organizing, and producing. During Tom's tenure, more than $65 million in private contributions have come to Field Museum. No one who knows anything about development work would suggest that it is a one-person operation. Tom had a distinguished institution and staff, an outstanding board of trustees, and dedicated friends of the Museum to work with. But Tom Sanders was the dynamo and the continuum, without which no development effort can succeed. His contributions were much more than pure fund raising. He understood the values of Field Museum, he is unfailingly loyal, and he possesses an energy level seldom seen in today's world. Perhaps more valuable than any other single characteristic, one working with him could always be assured that, regardless of any possible disagreements, Tom's opinion always expressed what he believed what was in the best interests of Field Museum. One never had to search for a hidden agenda. In short, Tom Sanders was a valued member of senior management.

Prior to joining the Field Museum staff, Mr. Sanders had served the Chicago Heart Association, the Community Fund-Red Cross Joint Appeal (now the Crusade of Mercy), the American Cancer Society, and for nine years was director of Development of Loyola University. Thus, his entire career has been in the field of development. The 35 years in development represent a great contribution to the organizations and institutions of Chicago.

All those who know Tom Sanders, and particularly those who have worked with him for the good of Field Museum, wish him and his wife, Mary, all the best in retirement. With those wishes come appreciation for a major contribution toward the advancement of the Museum.

—E. Leland Webber

Willard E. White Named Vice President For Development and External Affairs

Succeeding Thomas G. Sanders as Field Museum's chief development officer is Willard E. White, who joined the Field Museum November 28. Mr. White comes to the Museum from the Newberry Library, where he was vice president for Development and Public Affairs.

He has previously been a development officer at the Illinois Institute of Technology, Northwestern University, and the University of Chicago. Prior to entering the development field in 1977, Mr. White served with the journals division of the University of Chicago Press; as chief, Personnel Branch, Third U.S. Army, Atlanta; and as instructor in English at the University of Illinois, Chicago. He received his Ph.D. and M.A. in English literature from the University of Chicago and his B.A. from Denison University.

As vice president for Development and External Affairs, he is responsible for development, membership, tours, sponsored programs, government relations, external communications, marketing, public relations, and the *Bulletin*.

Clarification: Symposium on History and Evolution

We regret the understandable confusion generated by the announcement of the symposium "History and Evolution," which appeared in the February *Bulletin*. The reproduction of the announcement sent to universities and other scientific institutions across the country was intended not as an invitation for registration from the general public but rather as a notice to the membership of an activity of the scientific staff. This distinction was not made clear.

Coyote
Serigraph, 22" × 30"

COYOTE: A MYTH IN THE MAKING

Contemporary Native American art

April 8 to July 9

"Coyote: A Myth in the Making" presents the paintings and sketches of contemporary Native American artist Harry Fonseca. The exhibit focuses on Fonseca's vision of Coyote, a magical being prominent in the traditional literature and religious beliefs of many Native American cultures. The exhibit traces Coyote's history as he emerges from Fonseca's Maidu heritage and leaves the reservation to participate in many facets of American life. Through Coyote, Fonseca provides a lively commentary on con-

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A Gift from Colifornio
Serigraph, 22" × 30"
A Gift from Californio presents Fonseca's assertion that the Indian culture of California was alive and very different from that of the Southwest. The serigraph illustrates a women's dance, which honors both the acorn and women as givers of life; the four dancers carry burden baskets filled with acorns, a traditional staple of life for the Maidu and a symbolic representation of Maidu culture. The traditional Maidu basket designs are, left to right, winged lightning, angleworm, quail plume, and ants on a log.

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temporary urban life and timeless human nature. As an artist, Fonseca has developed his own style that has been referred to as "primitive," "naive," and "California funk." While his bold and colorful work reflects qualities of each of these styles, it goes beyond to create his own personal statement as a visual artist.

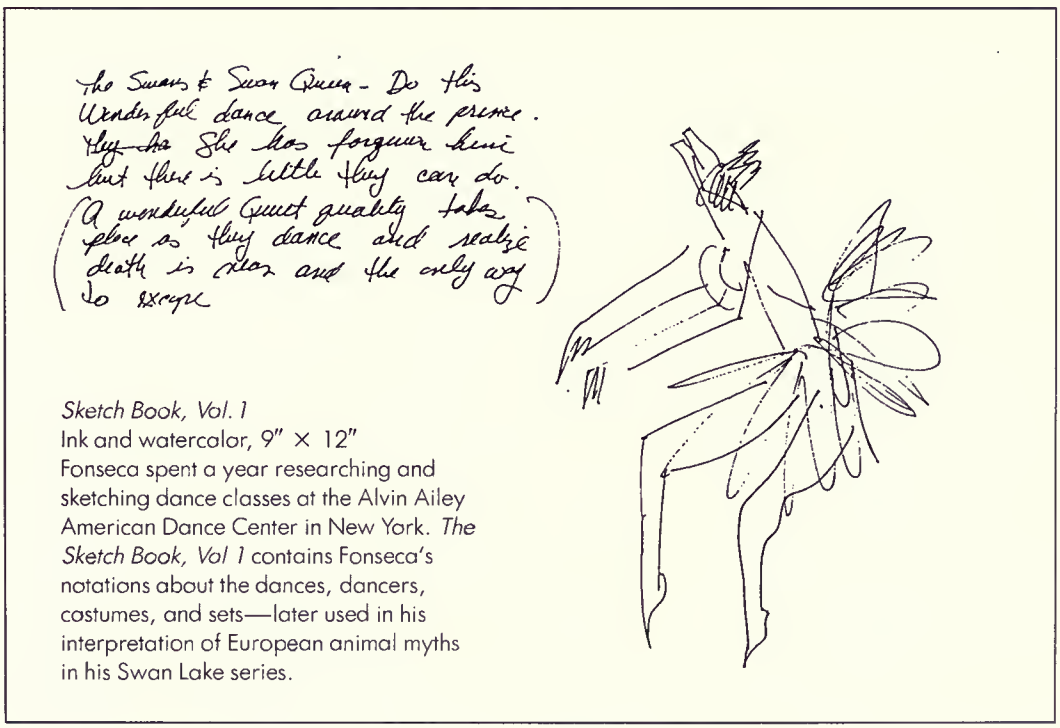
Among many Native American peoples, the coyote is a trickster figure. Among the Maidu of northern California, however, Coyote is more than just a spoiler—he also provides a guide through life, demonstrating what behavior is unacceptable and dangerous, providing opportunities for others to learn from his mistakes. According to Maidu oral tradition, Coyote is also responsible for the existence of work, suffering, and death. He is, on the other hand, a buffoon, the trickster who is only tricking himself, who comes out of his adventures in a sorry plight.

Harry Fonseca was born in Sacramento, California, in 1946; he is of Maidu, Portuguese, and Hawaiian descent, and he grew up in Sacramento acutely aware of his mixed heritage. However, he was greatly influenced by his uncle Henry Azbill, a Konkow Maidu elder, who encouraged him to attend the Maidu dances at Grindstone, near Chico. Azbill was a great promoter and preserver of the Maidu culture, which had undergone tremendous turmoil after the tribe was decimated following the influx of gold seekers and settlers to their land in California's northern Sierra.

Fonseca is largely self-taught: "I've been drawing this way since I was twelve years old," he said in a recent interview. His earliest works relate directly to his Maidu heritage. As part of an assignment for a class in American Indian art at California State University, Sacramento, Fonseca tape-recorded his uncle telling the Maidu creation myth. After recording the story, Fonseca realized that it was more than a creation myth; it was the tribal history. In 1976, Fonseca applied for and received a Special Projects Grant from the California Arts Council to aid in the making of the *Creation Story.* This marked the beginning of the three-year project that became the visual record of an oral history.

Fonseca's early works, created in the late 1960s through the 1970s, have been referred to as his "traditional" paintings—traditional because Fonseca was illustrating the Maidu culture, the dances, the regalia, and the basket designs, "the beginnings," as he said, "of the California people."

Coyote in front of Studio
Acrylic, 30" × 24"
Fonseca uses Coyote to poke fun at the familiar stereotype of the American Indian. The urbanized Coyote, in black leather jacket, Levi's, and high-top tennis shoes, wears the Hollywood-approved version of the most recognizable item of Indian dress, a full Plains-style feather headdress. Coyote also carries a large beaded leather bag and holds three cigars as he stands on a wooden box. Through Coyote's regalia, which is not worn in the artist's own Maidu culture, Fonseca satirizes the stereotype of the "real" Indian.



Sketch Book, Vol. 1
Ink and watercolor, 9" × 12"
Fonseca spent a year researching and sketching dance classes at the Alvin Ailey American Dance Center in New York. *The Sketch Book, Vol 1* contains Fonseca's notations about the dances, dancers, costumes, and sets—later used in his interpretation of European animal myths in his Swan Lake series.

Tom Hocker

Changing Chicago: Cultural Diversity

Photo Exhibition

April 22-September 4

THE ESSENCE of Chicago's diverse communities emanates from the still photography of six area photographers on display from April 22 to September 4, 1989. "Changing Chicago: Cultural Diversity" is one of five simultaneous exhibitions in Chicago organized by the Focus Infinity Fund. Field Museum's exhibit includes more than 100 black-and-white and color photographs by Dick Blau, Kerry Coppin, Tom Hocker, Jim Newberry, Marc PoKempner, and Richard Younker. The communities represented through their work include African-American, Polish, and Asian. The photographers participating in Field Museum's exhibition spent a full year documenting the customs, traditions, and values of their assigned communities.

O DARKLY BRIGHT

THE LABRADOR JOURNEYS OF WILLIAM BROOKS CABOT 1899-1910

Historic Photo Exhibit

On View until April 23

FOR MORE THAN TWO DECADES, beginning in 1898, William Brooks Cabot, a prominent American engineer turned explorer, made annual treks into the remote regions of the Quebec-Labrador peninsula to travel and live with small bands of Eskimo and Naskapi Indian hunters. The exhibit "O Darkly Bright" contains approximately fifty photogrophs that Cabot took of the people and lifestyles he encountered. Cabot was one of the first explorers to travel with a camera in Labrador and his photographs provide unique historical documentation of now vanished cultures.

The exhibition was developed by Stephen Loring, an anthropologist and archaeologist who has done extensive research on Labrador. In 1980 Loring tracked down Cabot's descendants and was given Cabot's original journals and more than 3,000 negatives, glass lantern slides, and photographs. The photographs in the exhibition are drawn from this collection which is now part of the Smithsonian's National Anthropological archives. "O Darkly Bright " can be seen in the gallery of the Webber Resource Center for Native Cultures of the Americas.

Young women at Kanekautsh Lakes, interior Quebec-Labrador, 8 August, 1910. Photo by William Brooks Cabot

The Christian A. Johnson Memorial Gallery
Middlebury College, Middlebury, Vermont 05753

"Human, Approachable, and Fun"
—The *Families at Work* Exhibit

By Fredelle Maynard

Ron Testa and Diane Alexander White

Just beyond the ancient China collection—past the marble sarcophagus and those austere deities (God of Creation, Judge of Purgatory), the Buddhas and bottles and polychrome bowls—visitors to the Field Museum this spring now find themselves in a surprising world. Here, stuffed and mounted, are a white-tailed doe with two fawns, a baby bat clinging to its mother in a windowless cave, a newly hatched monarch caterpillar.

Here, too, are cases of brilliant child garments from Pakistan, Botswana, Greenland, the American Southwest. Here are hand-fashioned toys from round the world—carts and dolls and balls and miniature farm implements. Life-size photographs of the world's families illustrate and elaborate displays. At the heart of the exhibit, under banners which identify its themes (*Bearing, Tending, Feeding, Carrying, Covering, Protecting, Teaching*), children—real live Chicago children—are playing. In the baby area, one toddler pushes a cart while another chatters into a disconnected phone; a third delightedly contemplates her own mirror image. Some mothers sit on bright floor pillows, directing and commenting. ("Look, Jason, A *white* bear, a *blue* fish, an *orange* carrot.")

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Others read aloud from the picture book collection or join in animated parent talk. ("What do *you* do when your kid throws a tantrum?") Beyond the baby-fence, a laughing, shouting, jostling group of preschoolers explores the possibilities of an imaginative play structure composed of differing heights, open-ended hardboard tubes. Created by Don Skinner, designer of the exhibit, the tubes have clear plastic tops which enclose bright, intriguing objects: silk leaves, fishes, a moon and stars. At the base of each tube, an open doorway invites movement and invention. "This could be a space ship!" "It's a forest!" "No, it's our *house.*"

What's happening here is lively evidence of the Field Museum's enlarged sense of purpose. For almost

Diane Alexander White

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a century now, this has been a world-class museum, eminent both as a research institute and as an agency of public education. Meanwhile, community composition and community needs have changed. The suburban population, split off from the central city, is less likely to use the Museum's resources. Blacks and Hispanics, now a majority of Chicago's population, have been underserved by the Museum's programs and

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underrepresented among its visitors. The very splendor of the building, its classic dignity and formality, may well make it less attractive to the present generation of visitors. Always solid, comprehensive, rich and varied in its holdings, the Field Museum has acquired an image awesome rather than exciting. Today the stated aim—while preserving its established tradition of scholarship—is to reach a new generation of museum-goers. *Centennial Directions,* a looking-forward document published in October, 1986, sets forth an agenda for the future: "to offer informal exhibits and programs, providing direct, hands-on experiences with natural history materials and themes"; to attract a broad range of museum-goers, from casual lookers to serious scientists; to make the Museum's vast resources more usable; above all, "to lighten the public face of the Museum, making it more human and approachable."

Families at Work is a brilliant first step in this direction. On the most obvious level, it's a refreshment for the gallery-goer: an attractive space where parents can release babies from backpacks and strollers, at the same time providing older children with a child-centered exhibit and the opportunity for imaginative play. Oversize photographs surrounding the area suggest the universality of parent tasks; here's a father giving a bottle, a robin with worm and eager babies, a mother breastfeeding twins. Both parent and child visitors are led—casually, without didacticism —towards an understanding of family structures and practices. The free arrangement of exhibits—fox and cubs next to a photo of father with backpack—invites reflection. What have animal and human families in common? How do they differ? What do the toys of China, Indonesia, South Africa tell us about the culture of those countries? How do parents in all parts of the world prepare the young for adult roles and responsibilities? Unlike conventional museum labels, with their facts and figures and Latin names, the labelling here is offhand, provocative. The exhibit of Khoi-Khoi dolls, for example, provides no pedestrian data. (Assumption: you can see what there is to see.) Rather, it asks: "What does this doll family teach children about adult life?" A child who tires of racing through the tubes or manipulating beads on the marblechase, can choose any exhibit (all cases are at child's eye-level) for a moment's quiet observation. *Oh boy, oh boy, look at that sword. Do Japanese kids really get to play with stuff like that?* Or *The baby rabbits look like mice. When do they get their fur?*

Families at Work poses a question: What are families for? What common impulses unite the mother raccoon with her tumbling babes, the talismans attached to children's garments in many cultures, the ingenious toys constructed of locally available materials—rushes, gourds, animal bones? A useful formulation comes from Dr. Dorothy Gross, of New York's Bank Street College of Education: "What the young need, what parents provide, is affection, protection, role modelling and elbow room." *Protection* is the bottom line. *Families at Work* shows how animals born naked and blind are sheltered in nests where parents keep them safe and warm. Human babies are swaddled, strapped onto carrying boards, bundled into baskets and backpacks. (Some carriers come equipped with drainage facilities; others divert young riders with bouncing devices and jingling bells.) In the insect world, protection may be a simple matter of shielding eggs and larvae from predators; more sophisticated, but still instinctive, is the canny ruse of the killdeer faking a broken wing to distract attention from the vulnerable eggs. Human parents move beyond physical protection to spiritual; the exhibit showcases a wonderful variety of supernatural defenses against harm: the Chinese silk lion, stuffed with fragrant leaves to protect a playing child, Indonesian charm necklaces, a Sioux Indian turtle amulet containing—magic specially potent—a piece of the wearer's umbilical cord. Even color may be chosen for its magical properties, like the yellow dye of Kiowa Indian leggings. Most often charms are worn, but some may be placed by cradle or basket, like the silky Ojibwa nets designed to catch bad dreams, or the evil-looking fungus used in Madagascar to scare off malign spirits.

Affection, surely revealed in the multiple

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ingenious devices by which human parents hope to safeguard their young, appears vividly too in children's garments. In a very real sense, here, clothes make the man (or woman), foreshadowing adult roles and responsibilities and expressing the values of the culture. From the Eskimo parka to the brief pubic shield of a Javanese girl, clothing typically moves beyond merely practical considerations to celebrate the child and his hoped-for future. The silk coat of a Chinese infant is richly embroidered with symbols of health, wealth, and power: a cat to protect against evil spirits, butterflies for happiness, and the swastika-shaped *wanzi* for luck. A woolen jacket for a Guatemalan boy displays the quetzal bird motif, symbolizing greatness. Clothing the world over is in fact a rich language communicating, besides feeling, the wearer's status, the community's resources and, frequently, the pure art impulse of elaboration. One of the exhibit's most enchanting items is an infant hat from Pakistan, a kind of helmet with elongated ear flaps, extravagantly decorated with a mix of traditional embroidery and commercial artifacts. The cap is edged with white beading (no surprise), hung with silver coins and small bells (no great surprise) and then improbably finished off with key chains, pearl buttons, and split zippers.

Role modelling begins in children's garments—often, as the exhibit reveals, miniature versions of adult apparel. The suit for a four-year-old Bagobo boy of the Philippines is a perfect replica of his father's, down to the attached sling bag . A young girl

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of the Karok—a California Indian tribe—destined to be a healer and dance leader early assumes ceremonial garments. Above all, though, it's in play that role-modelling and *Elbow Room,* hanging loose, come together. Is the Cameroon child's tiny Land-Rover life-learning, or pure highjinks? In *Families at Work*—the exhibit and the real-life activity—play emerges as both diversion and serious business. When an adult plays—at golf, dancing, chess—he turns aside from his "real" work to relax; this is recreation. But the child's play is a continuous act of creation. Running or digging, building or pretending, the child creates *himself;* he discovers who he is, what he can do, how things work, where he fits into the total scheme. The cradle board encourages nurturing, the bow competition. A Cheyenne boy's slingshot is not just amusement (though it's surely that); it's practice in developing eye and hand for targeting small game. With his toy rake, the Indonesian child prepares for life in the rice fields, just as the young Malay moves towards *his* destiny with a miniature cart made of coconut husks. The child-size Japanese sword, the scaled-down Hopi bow and arrow—these toys express the culture's values and standards. Children envy—how can they not?—what seems the absolute freedom and power of adults. And when they rush out to play—with ball, top, wagon, skates—they're impelled not only by a desire for fun, but by a drive for mastery, over themselves and the physical world.

Many young creatures play. Look at the fox cubs in a *Families at Work* display—pouncing on wind-blown leaves, chasing each other's tails. Just as this kind of play looks ahead to the adult hunt, so children's games (and the toys parents provide) constitute a special kind of life preparation. Consider the doll. The most minimal one, in this exhibit, made by the Naskapi-Montagnais Indians, is a paper cutout, a crude representation of the human form cut into birchbark. Without features, without sex, this dehumanized figure suggests a culture in which natural and supernatural forces dominate man. The Ndebele bead dolls, and the straw dolls of Ecuador (with bells concealed in bright skirts) express a delicate, decorative image of woman, contrasting strongly with a lusty leather doll from southern Africa, her sexual role accentuated by breasts, thrust buttocks, and back-borne infant. A Japanese *daruma* doll, designed to teach fortitude, armless and legless, is all head; the Cheyenne doll, on the other hand, has a head the size of a bead. Some cultures produce baby dolls; in others, dolls represent adult ideals. And then there is Barbie, the

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All-American dream. Seeing her in this context, viewers may be moved to reflect on the elements of that dream. With her improbably small feet, long legs, perky breasts, elaborate hair, and bland expression, she seems neither mother, sexual partner, nor worker but a fantasy of purely decorative femininity. (Barbies come, these days, with briefcases and hard hats for construction work, but one can't take such accessories seriously. Would Barbie do anything likely to disarrange costume or hair?)

In the low-walled enclosure of *Families at Work*'s play space, two preschoolers squabble over a puzzle. "I had it first!" "My turn!" When push and pull fails, the smaller child offers a canny solution. "Let's *both* do it!" Together, they make short work of the puzzle; having discovered the pleasures of *both*ness, they move towards the baby doll and the wagon. "I'll be the mother and you can be the bus driver." The bus driver's mother, meanwhile, has made herself comfortable in a nest of bright pillows. Asked what she thinks of the exhibit, she offers a brass-tacks response. "It's great to sit down and let the kids work off some energy. They hate being dragged around museums, and half the time they can't *see*." A father—he's a recent immigrant from Guatemala—says, "I like that here we all learn. I talk to American parents. I watch." Other visitors join in. "My boys mostly play in the tubes. But then they'll race over to look at the stuffed deer, or the toy sword." "I think a dress-up box would be great. Stuff like what they see in the cases, the wild hats and shoes." Some parents would like more things for children to make and *do*; some wish the Museum would provide staff to answer questions about child care and development. A father asks if there couldn't be at least one live animal for children to observe. There's a silence while parents mull over these possibilities. Then a young woman who identifies herself as a university student of Early Childhood says, "The Field's full of good stuff. What's special here is the *feeling*—about families and the young. Like that little jacket from Panama, the one with reverse appliqué and a hood. That's not about keeping a kid warm and dry. It's about love, and celebration, and hope." **FM**

A Chicagoland pond in April. Dave Walsten

Musical Amphibians Of Chicagoland

By John C. Murphy
frog photos by the author

Frog choruses have always held a special fascination for me. With the exception of a few spectacular bird and primate calls and those of emerging cicadas, no animals' auditory display can, in my estimation, rival a chorus of frogs.

I have waded in sloughs with alligators and venomous snakes, warded off hordes of mosquitoes, climbed trees while wearing chest waders, laid on snow-covered ground, and been preyed upon by black flies, leeches, and other creatures—all for the singular delight of listening to frogs and studying their behavior. But anyone who wants to observe calling frogs in the Chicago area can do so without many of these inconveniences; and now, as we advance into spring, the opportunities to do so are abundant.

The presence of frogs in a forest pond can usually be determined by a nighttime visit in spring or early summer. While just sitting in the car with the window rolled down and engine turned off one can hear the frog chorus, but approaching the sound to actually watch the calling frogs is something else. Listening to them, then locating the source of their call is challenging and

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requires some patience, but it is an excellent way to learn how to identify them by their vocal characteristics. In some cases, as described below, identification is easier on the basis of sound rather than appearance.

Frogs are necessarily sensitive to the approach of any large animal, particularly one that may be interested in them as food. Even the most casual observers have probably noticed that while approaching a pond where frogs are calling, the closer ones go silent while those farther off continue. Most of the Chicago-area species—there are 13 around Chicago, about 20 in Illinois—call from the water or from vegetation emerging from the water, and such frogs detect movement from waves created by the intruder.

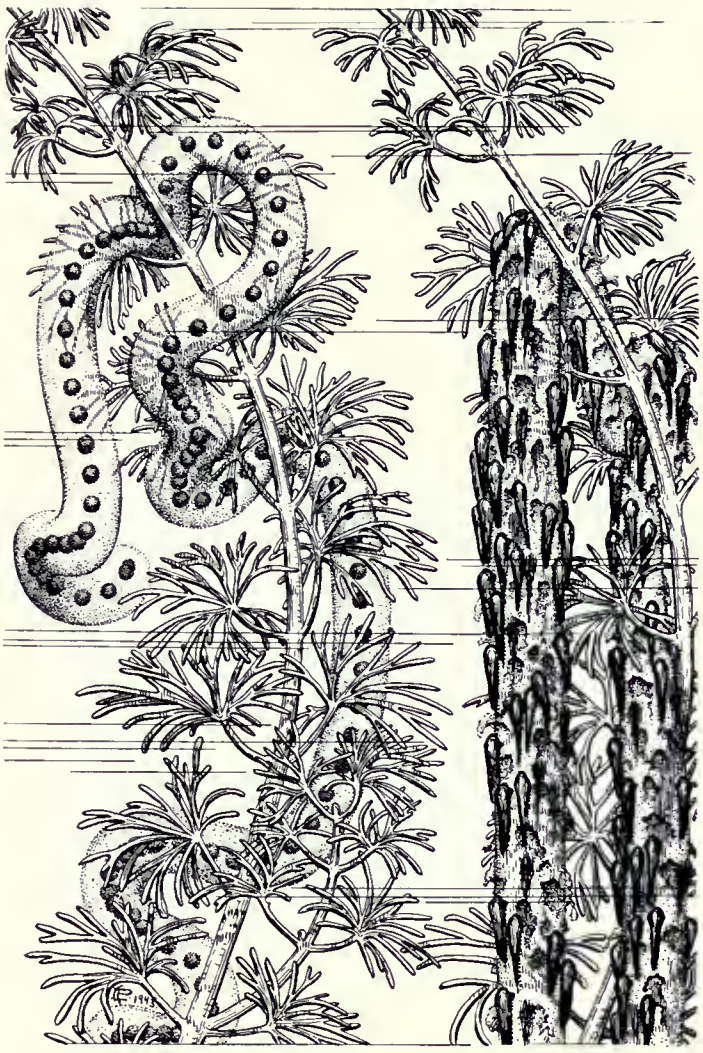
Frogs are tailless amphibians: animals that usually pass through an aquatic fish-like larval stage before becoming adults. Like salamanders, which have tailed adults, frogs are dependent on water for reproduction and for exchanging oxygen and carbon dioxide through their skin. Adult frogs are carnivorous, eating mostly insects, but a few large species eat birds or mammals. Lacking true teeth, frogs must capture their prey with jaws, tongue, and occasionally, their front legs, and swallow it whole.

Two of the Chicago-area frogs are commonly called toads. There is no scientific distinction between frogs and toads, but most tailless amphibians known as toads are in the family Bufonidae, which contains almost 300 species worldwide; many have thick, glandular, warty skin, and land-dwelling adults. Toad eggs can be identified by the fact that they are laid in a long chain, usually on vegetation, in shallow water.

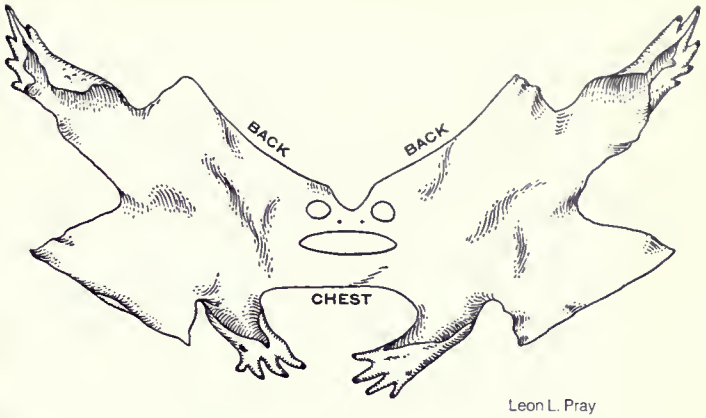
Eastern American toad, *Bufo americanus americanus*

The eastern American Toad, *Bufo americanus americanus,* is probably the most frequently encountered amphibian in northeastern Illinois, inhabiting many bodies of water in the urban and suburban areas during the breeding season and spreading out from the ponds in late spring to feed, often in gardens and lawns. Depending upon temperature, sometime during April, and usually at night, males migrate to the breeding ponds and females soon follow. At the peak of the explosive breeding season, the male toads call during daylight hours; this diurnal calling may last only one or two days, but a week or so before this peak and for a

Fowler's toad, *Bufo woodhousii fowleri*

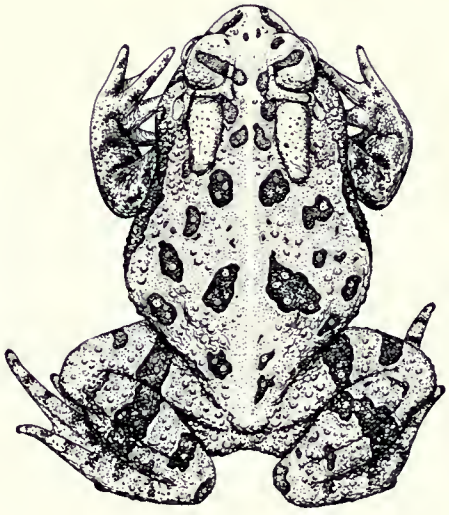


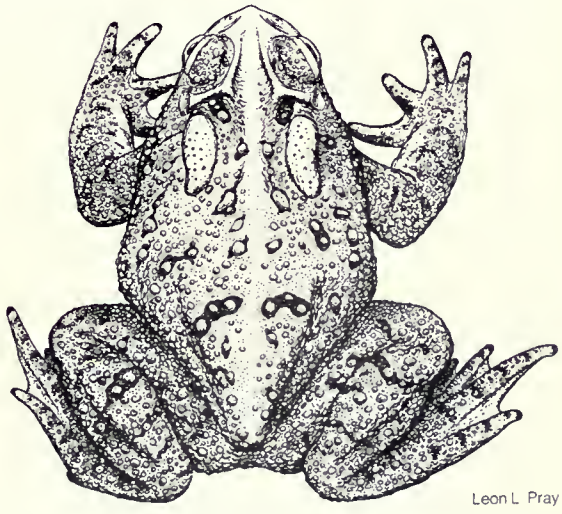
Left: Egg chains of American toad 24 hours after being laid. *Right:* The same chains three days later, showing newly hatched tadpoles. After Dickerson.



Leon L. Pray

Molted skin of American toad





Leon L. Pray

Note the differences here in warts and blotches between Fowler's toad (top) and the American toad (bottom).

month or more afterward, the males can still be heard calling, usually after dark. The purpose of all this noise is to advertise the male's presence to females and to warn other males to keep their distance. Calling males stay about 36 to 60 inches apart; if one male ventures too close to another, he may be driven off by an agressive charge.

The call of this toad is a sustained, musical trill lasting 6 to 30 seconds, one that is not easily forgotten and which may be heard as far away as a quarter mile. The time needed for egg and tadpole development varies with temperature and other factors, but small toadlets become obvious during mid- to late summer. Females reproduce for the first time at three years of

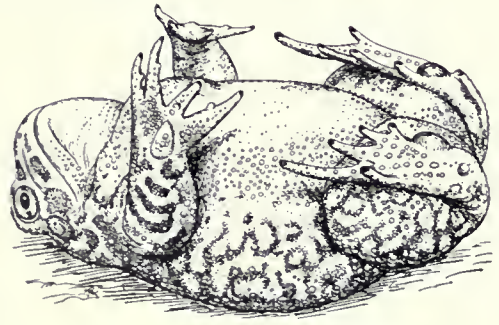
Blanchard's cricket frog. *Acris crepitans blanchardi*

age, males reproduce at age two. Females grow to a body length of 4.5 inches, males are smaller, but average size for both sexes is 2.0 to 3.5 inches.

Fowler's toad, *Bufo woodhousii fowleri*, is similar to the American toad, and for the casual observer distinguishing between them can be difficult. The American toad has a darkly mottled breast, as do some Illinois Fowler's toads; however, most Fowler's toads have a solid white or cream underside. Fowler's toad has larger dark dorsal (back) blotches with three or more warts per blotch, while the American toad has only one or two warts per blotch. There are other subtle differences, but the situation is further complicated by the occasional interbreeding of the two species, with resultant hybrids that show characters of both.

Fowler's toad seems to have a preference for sandy soil, while the American toad prefers darker, organic rich soils, and Fowler's toad usually breeds later in the spring. However, I have seen both species calling together at a dark-soil locality. The voice of Fowler's toad—quite different from that of the American toad—is a nasal "waah," lasting one to four seconds.

Fowler's toad feigning death. After Dickerson.



Fowler's toads average 2 to 3 inches in length, but large females reach 3.75 inches.

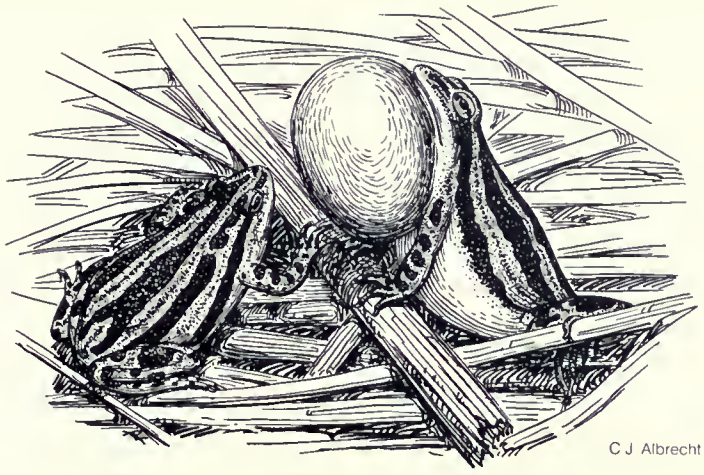
In the New World, the treefrogs, family Hylidae, range from cold temperate latitudes in North America, through the tropics, to cold temperate latitudes in South America. The family contains about 630 species, with diverse adaptations to the many environments they inhabit. Despite the common name "treefrogs," some do not climb at all, while others spend their entire life in the forest canopy.

Blanchard's cricket frog, *Acris crepitans blanchardi*, was considered the "most common amphibian in Illinois" by Philip W. Smith in his 1961 book *The Amphibians and Reptiles of Illinois*, published by the Illinois Natural History Survey. However, this tiny, 0.75-1.5-inch frog underwent drastic population reductions in the next two decades.

Western chorus frog, *Pseudacris triseriata*

It is a ground-dwelling treefrog with numerous small warts and may have a green or rust-colored mid-dorsal mark. Its cryptic coloration makes it all but invisible when sitting on a muddy shoreline with small pebbles. As one approaches a cricket frog along the shoreline, it waits until one is three to four feet away, then leaps into the water and swims out; within seconds, however, it turns back, returning to within a short distance of its original position.

Males call in late April with a series of short, metallic clicks. Newly metamorphosed individuals (*i.e.*, transformed from tadpole to frog) are present in late summer or early fall. An Iowa study found that they feed continuously day and night during the seven months of the year they are active. They eat any small arthropod, mostly insects, consuming about 20 prey



Female western chorus frog (left) approaching a male.

items per day, or 4,800 prey per year per frog. Thus, a small population of 1,000 frogs would consume 4.8 million arthropods per year.

The western chorus frog, *Pseudacris triseriata triseriata*, is a 0.75-1.5-inch frog with three broad stripes on its back and a light line along the upper jaw. This abundant frog is heard calling in large choruses in March and April; the call of a single frog is best described as the sound made by a running a finger slowly over a comb's teeth. As settlers moved into the midwestern grasslands during the 1800s, chorusing chorus frogs provided the musical background for man's alteration of the prairie. Today, chorus frogs will use almost any shallow body of water for reproduction—cattail marshes, flooded farm fields, suburban drainage ditches, even water-filled tire tracks. Small clusters of eggs in gelatinous masses float in the water or are attached to submerged vegetation. Chorus frogs rarely climb and are relatively poor swimmers. After reproducing, the adults spread out into surrounding upland habitats, sometimes where it is quite dry, to feed.

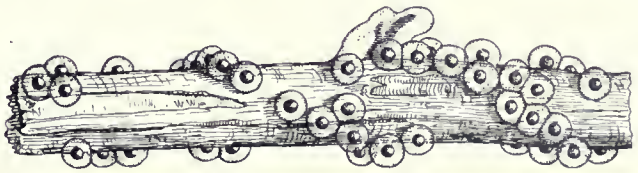
The western chorus has an interesting relative in central Illinois, the Illinois chorus frog, *Pseudacris streckeri illinoiensis*, a frog unknown to science until 1950. This is a subterranean treefrog, a true paradox, that burrows into the sandy soil of Illinois sand prairies and feeds while underground. Males may chorus while the ground is snow covered, in March and April.

The spring peeper, *Pseudacris crucifer crucifer*, has been long considered a true treefrog and placed in the genus *Hyla*. However, it has recently been reassigned to the chorus frog genus, *Pseudacris*. The spring peeper can be readily identified by the large X on its back. Like

Spring peeper, *Pseudacris crucifer crucifer*. Note characteristic X on back.

the toads and chorus frogs, it is an explosive breeder; large choruses sing day and night for a day or two in late March or early April, until most of the eggs in the population have been laid and fertilized. The male's call is a single, clear, high, piping note. This call is used to

Eggs of spring peeper attached to submerged plant stem. After Wright.



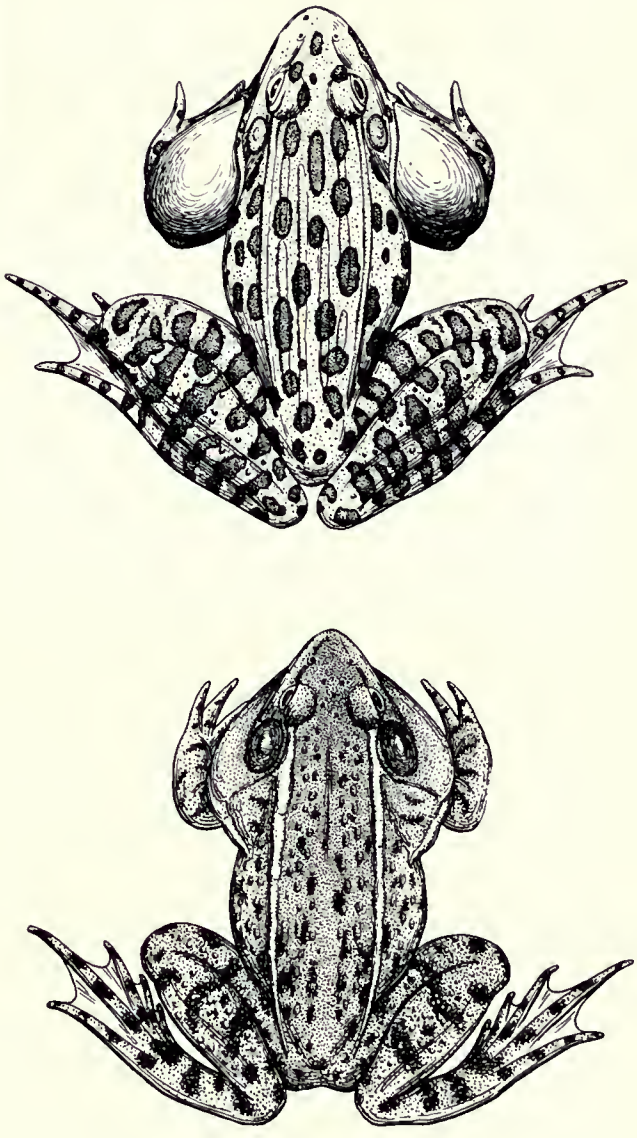
Gray treefrog, *Hyla versicolor*

advertise the male's presence; however, when another male gets too close, the single notes become a trill, a signal that the caller's territory is being invaded. After the breeding period, males still call, but in small choruses, or singly. Unlike the western chorus frog, the female spring peeper deposits one egg at a time on submerged vegetation after it has been fertilized; thus, the eggs are not found in gelatinous masses, but are scattered along stems and leaves.

The gray treefrog, *Hyla versicolor,* and Cope's treefrog, *Hyla chrysocelis,* are considered together because, even to the trained naturalist, they look alike and both are about 1.5 to 2.0 inches in length. Because of this similarity, they are still sometimes collectively called gray treefrogs. The gray treefrog has a slower, guttural trill, but to distinguish it from Cope's in the field, the two must be calling near each other so their calls may be compared under the same conditions—temperature affects the speed of frog calls; the warmer the frog the more rapid the call.

These normally gray frogs can change to green or to a pasty-white, have bumpy skin, webbed toes, fingers ending in expanded disks, a distinctive white spot under the eye, and yellow and brown mottling on the groin and hidden surfaces of the thigh. Males have a single vocal sac and a rough pad of tissue on the inner thumb. The thumb pad is used for gripping the female during amplexus, or mating. During dry weather these frogs live in tree hollows, under tree bark, in rotten stumps and even abandoned bird houses. The two gray treefrog species spread their reproductive activity from April to August, latitude having some influence on the timing.

Two other species of true treefrogs are found in the southern part of Illinois. The bird-voice treefrog, *Hyla avivoca,* is a miniature version of the gray treefrogs, being 1.2 to 1.75 inches in length, and it inhabits wooded swamps. This treefrog's call has been described as the most beautiful of all in North America. Males produce a clear, bird-like whistle at a pulse rate of about two to five per second. The green treefrog, *Hyla cinerea,* is leaf-green with a creamy side stripe, is 1.25 to 2.0 inches long and inhabits swamps and marshes. Green treefrogs have a "quank"- or "quonk"-like voice, but when a large chorus is close to synchrony the sound produced is similar to cow bells. Both the bird-voice



Male frogs with vocal sacs inflated. *Top:* leopard frog; *bottom:* green frog.

Wood frog, *Rana sylvatica*

and green treefrog are gulf plain species, extending their range into extreme southern Illinois.

The true frogs, family Ranidae, is a collection of about 650 species that is almost worldwide in distribution. It contains many species that are less than one inch long, but it also contains the world's largest frog, the African goliath frog, *Conraua goliath*, that has a body length of 12 inches. The habits of ranid frogs are as variable as their body sizes, but all of the Illinois species have webbed feet, free fingers (fingers that lack webbing), smooth skin, long legs, and narrow waists. Males may have single or paired vocal sacs, one on each side of the throat.

The wood frog, *Rana sylvatica*, is the only frog in the Chicago area that has a dark brown mask through each eye. Adults are 1.5 to 3 inches long, males being smaller than females. Wood frogs are active in late February or early March, appearing in woodland ponds and breeding as soon as the air temperature reaches 50°F. During the breeding season males are darker than females and have swollen thumbs. Males also have paired vocal sacs and a duck-like hoarse cackling voice which says "waaaduck," lasting about one second.

Bullfrog, *Rana catesbiana*

Wood frogs are an explosive breeder, laying all their eggs in a few days. Clutches of 500 to 1,000 or more eggs are laid in forest ponds and hatch in 10 to 14 days. Tadpoles transform in May or June. In Illinois this frog is restricted to small, localized populations where suitable forest habitat exists; thus, they are uncommon in the Chicago area. The species is frequently associated with beech-maple forests, in the eastern part of the country, and lives farther north than any other amphibian—above the Arctic Circle.

The bullfrog, *Rana catesbiana,* is the largest native North American ranid frog, averaging 3.5 to 6.0 inches in body length and sometimes attaining 8 inches. It differs from the green frog by lacking skin folds along the sides. Bullfrogs are usually green, but they change colors and may be green-brown. Males have a yellow throat during the breeding season. Their single, internal vocal sac generates a vibrating snore that somewhat imitates the phrase "jug-o-rum." When a group of males are in a synchronous or near-synchronous chorus the sound produced is similar to that of a freight train. Bullfrogs actively call and reproduce from late April throughout most of the summer until August. A clutch of eggs may contain 20,000 or more and form a floating raft one egg thick that may be 3 feet or more in diameter. Females sometimes lay two clutches per season. The eggs hatch in 4 to 5 days; tadpoles overwinter, and may exceed 6 inches in length, transforming in their second summer. Bullfrogs will eat anything that moves and are considered pests in many locations, threatening the survival of smaller frog species, which are commonly eaten. Bullfrogs are, in fact, attracted to the distress calls of other frogs.

Green frog, *Rana clamitans melanota*

The green frog, *Rana clamitans melanota,* is similar in appearance to the bullfrog but has a fold of skin on each side of its back. Green frogs average 2.25 to 3.5 inches in length, but may reach 4 inches. They are green to green-brown above, with a white underside. Like the bullfrog, they are habitat generalists, using almost any body of freshwater. Reproductive activity extends from April to September, with most of the activity probably occurring in June. The male's advertisement call is a loud squawking "bong," repeated several times; it is similar to the sound made by plucking a banjo.

A clutch may contain more than 4,000 eggs, which hatch in 3 to 6 days, depending upon temperature. The tadpoles overwinter and transform the following season. Green frogs reach very high population densities. At one northern Illinois beaver pond I estimated that there was more than one green frog for every square meter of pond surface. While walking along the edge of a stream or pond, an observer may often frighten a green frog, which then jumps into the water, uttering a distress call that sounds like a banjo string breaking under stress—a sound unlike any other Illinois frog distress call.

In northern Illinois, the pickerel frog, *Rana palustris,* prefers ponds, creeks, and marshes. Elsewhere it uses caves, bogs, fast-moving streams, and springs. It is rarely found in the Chicago area. This 1.75-3-inch species has a double row of squarish spots on the back, as well as a yellow or yellow-orange area on the underside of its hind legs, which distinguish it from the two leopard frog species (described below). Reproduction

outside the Chicago area has been reported from March to May. Males have double vocal sacs that produce a low-pitched, musical snore lasting one or two seconds, and males may call while they are submerged. A globular clutch of 2,000-3,000 eggs is usually laid in clear, shallow water with a temperature between 50° and 65°F. These hatch in 10 to 14 days.

Northern leopard frogs, *Rana pipiens,* are common and frequently encountered around streams and ponds. They may be brown or green, with two or three rows of

Pickerel frog, *Rana palustris*

round spots on the back; the spots may be scattered, run together, or missing entirely. These frogs average 2 to 3.5 inches long, but sometimes exceed 4 inches. Males call with paired vocal sacs from shallow, stagnant water with vegetation, and may call while submerged. This habit makes them difficult to be heard and more difficult to locate. The sound has been likened to that made by rubbing a finger over an inflated balloon, but it often consists of a one deep snore that is interrupted with a clucking grunt that lasts about a second. Three to five thousand eggs are laid between March and May in spherical masses and the eggs hatch in about seven days. The tadpoles transform from June to August. Adults spend the summer months replenishing their energy supply by capturing insects and spiders in grassy habitats near their egg-laying sites. Leopard frogs have long been used as laboratory animals and, as such, one would think that everything would be known about these frogs; that is not so.

Northern leopard frog, *Rana pipiens*

The plains leopard frog, *Rana blairi,* was described in 1973. Until then it had masqueraded as the northern leopard frog. It is widely distributed in the central plains, but its separate identity was not noted because of the similarity in appearance to its sister species. Externally, the plains leopard can be distinguished from the northern leopard by a broken fold of skin on each side of the back, and occasionally by yellow coloration on the abdomen and thighs. Another major difference is in the pulse rate of the mating calls; the plains leopard frog calls at about five or six pulses per second, while the northern leopard frog calls at a pulse rate of about twenty per second at temperatures below 75°F. Further complicating the leopard frog situation is a *third* species found in the southern part of the state—the southern leopard frog, *Rana sphenocephala.*

Three other frogs that inhabit Illinois are found at the southern end of the state and tend to be restricted in distribution or very secretive. The northern crayfish frog, *Rana areolata circulosa,* gets its name from spending much of its time in crayfish burrows, as well as from eating small crayfish. The great plains narrowmouth toad, *Gastrophryne carolinensis,* is small and squat, has a collar-like fold of skin behind its head, runs on all four feet in a very unfrog-like way, and spends much of its time eating ants. The eastern spadefoot toad, *Scaphious holbrookii,* is subterranean, coming to the surface to reproduce after heavy rains. **FM**

Suggested Readings

R. Conant: *A Field Guide to Reptiles and Amphibians of Eastern and Central North America,* 429 pp., 1975, Houghton Mifflin.

C. Pope: *Amphibians and Reptiles of the Chicago Area,* 275 pp., 1944, Chicago Museum of Natural History (Field Museum).

P. Smith: *The Amphibians and Reptiles of Illinois,* 298 pp., 1961, State of Illinois, Dept. of Registration and Education, Natural History Survey Division.

Pipe with catlinite bowl and stem wrapped in fur, Potawatomi. Cat. 155801
Photo by Diane Alexander White. neg 110294c

CONSERVATION SYMPOSIUM FOR COLLECTORS

Saturday, April 22
9:30am to 12:30pm

Do you have a collection of quilts, books, or photographs? Are you uncertain about how they should be displayed or handled? If so, come to Field Museum on Saturday, April 22. In the Founders' Room, from 9:30am to 12:30pm, a panel of conservation experts will discuss basic care and handling of a variety of materials. Learn about the major causes of damage and deterioration to collections and what precautions you can take to avoid them. Find out when to call a professional conservator.

SPEAKERS

Carol Turchan on *photographs*
Bill Minter on *books*
Nancy Rubin on *textiles*
Christine Del Re on *objects*
Mary Lee on *paper*
Faye Wrubel on *paintings*
Catherine Sease on *general problems*

Come with as many questions as you like, but please do not bring in objects for discussion. Space for this free discussion is limited, so please call Mona Barz at 322-8885 by April 14 to reserve a place.

You board a large, well-connected airline and fly across the Atlantic. You land.

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FIELD MUSEUM TOURS

Southwestern China Cultural Relics Study Tour

September 15 - October 6
Leader: Katherine Lee Yang

Street peddler with wares, Yunnan. Katherine Yang

Sept. 15. Chicago/Tokyo. Your adventure begins as you board Japan Airlines flight #9. Departure 12:00 noon.

Sept. 16. Tokyo/Hong Kong. Arrive Tokyo 2:45 p.m. Connect with Japan Airlines Flight #65 at 5:30 p.m. to Hong Kong. Arrive at 8:50 p.m Overnight at Shangri La Hotel.

Sept. 17. This morning we fly to Kunming. After transfer to the hotel, the remainder of the day is at leisure. This evening you are invited to a banquet hosted by the provincial government.

Sept. 18. Visit the Unnan Provincial Museum. Several professionals who are specialists in their field will give us an introduction to the study program we'll cover in the next two weeks.

Sept. 19. This morning we leave by deluxe motorcoach for a countryside tour of Dali and Lijiang. Few foreign visitors have seen this area. We will have an opportunity to observe the life style of Han, Bai, and Naxi people. We will stay in the unique architectural style of Bai houses at Erhai Guest House. It is a walled compound; three sides are built with rooms while the fourth side is used as a backdrop displaying ornamental bonsai trees or flowers.

Sept. 20. This morning a well-known archaeologist in Dail will introduce us to Dali Nanzhou culture of the eighth century. We'll visit several sites as well as take a cruise on Lake Erhai. On our return we see homes where handicrafts are made, and how marble products are cut and polished.

Sept. 21. Today enroute from Dali to Lijiang we will see the beautiful mountains of southwestern China and we'll visit the Jianchuan cave stone carvings of the Tang Dynasty. Tonight we'll stay in Lijiang No. 1 Guest House.

Sept. 22. A scholar of Naxi minority culture, Mr. Zhao Gin Xiu, will help us understand the history, the people, and their way of lite. Mr. Xiu was featured in the *National Geographic* article "Mountain World." As we walk through old *Fang Chen*, meaning "Square City," our experience will be enhanced by the expertise of Mr. Zhao and Mr. Lee Zi, the director of Lijiang Museum.

Sept. 23. We leave today for Dali, and enroute we will walk through Xhou Chen, where we will visit homes to see how traditional tie-dying is done. We will examine the process of marble finishing. As we are approaching Dali, we will stop to see three Pagodas at Chongsheng Temple, which were built in the late Tang dynasty.

Sept. 24. Today we return to Kunming, with some leisure time to reflect on the memories of Yunnan's hidden treasures. Then we prepare for our departure to Chengdu, Sichuan to experience another culture of China.

Sept. 25. This morning we fly to Chengdu and transfer to Jin Jiang Hotel (West Wing). After lunch we will walk through the marketplace near the hotel to see how shopping for food is done in the most populated province in China. This evening the Sichuan Cultural Department will host us to a banquet at Lai's Restaurant, where we will enjoy the world-famous Sichuan cuisine.

Katherine Yang

Grandmother and granddaughter, Yunnan.

Sept. 26. Today we will visit the Chengdu City Museum and Sichuan Provincial Museum, and Wang Jian's Tomb. We will see the bronze artifacts recently discovered in San Xin Due.

Sept. 27. We will begin our four-day countryside motorcoach tour to Meishan, Leshan, and Zigong. Our first stop is at San Su Shi (The Three Su's home estate) at Meishan. After lunch at San Su Shi, we will walk around the estate to see the home/garden architecture of southwestern China. We will arrive in Leshan in the evening for dinner and overnight at Jia Zhou Guest House on the shore of the Mian river.

Sept. 28. After breakfast we take a boat ride across the Mian river to see the Big Buddha. We then walk on a paved path along the river to Mao Hao Cave tombs, to observe a unique way of burial during the Han Dynasty. This afternoon we depart for Zigong by motor coach. Overnight at Tan Mu Lin Guest House.

Sept. 29. This morning we will visit the Salt Museum at Shaanxi Salt Merchants Guild. The exhibits are interesting; however, the architecture of the Shaanxi Salt Merchants Guild is outstanding.

Sept. 30. We travel from ZiGong to Chengdu.

Oct. 1. A day at leisure. We can help the Chinese celebrate their Independence Day. It is the 40th anniversary of the founding of the new government.

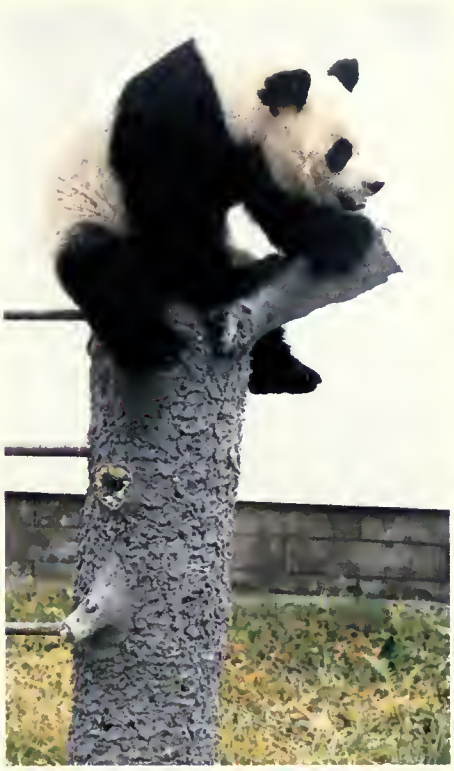
Oct. 2. We take a scenic motorcoach trip from Chengdu to the Wolong Panda Reserve District. We will stop enroute to visit farm families and a small botanical museum hidden in the mountains.

Oct. 3. Our itinerary will be adapted to the flight schedule for the return to Hong Kong. We will schedule time for rest and prepare for our return home. There will be a farewell banquet this evening hosted by the Sichuan Province.

Oct. 4. Departure from Chengdu in the early afternoon. We will arrive in the evening and transfer to the now familiar Shangri La Hotel (Kowloon) for the night.

Oct. 5. This morning we fly to Tokyo, arriving in time to enjoy a leisurely evening. Overnight at Narita Hotel.

Oct. 6. Today we continue our journey home, leaving Tokyo on Japan Airlines flight #10 at 12:00 noon and arriving at Chicago O'Hare at 9:25 p.m.



Katherine Yang

Panda in Wo Long Panda Reserve Center.

This is an outstanding cultural study tour which we believe is an excellent itinerary, especially for those who have previously visited China. It is the first time this area has been opened to visitors. Katharine Lee Yang was accompanied by government officials as they established the itinerary, and she has given Field Museum Tours the opportunity to offer the first tour. As many of you know, Katharine is an exceptional tour leader, and we are pleased to offer this program. We do not have the price finalized as of this writing, but we invite you to call for more information. An evening program will be scheduled at the Museum to show slides and give a more complete orientation about this area of China. We invite you to join us. Please make reservations by writing or call 322-8862.

TURKEY
PAST & PRESENT

October 21 - November 4, 1989
Leader: Dr. David S. Reese

Dali city gate, Yunnan. Katherine Yang

For reservations, call or write Dorothy Roder (322-8862), Tours Manager, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Il 60605

Field Museum of Natural History
Membership Department
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605-2499

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FIELD MUSEUM

THE SMART WAY TO HAVE FUN.

FIELD MUSEUM OF NATURAL HISTORY BULLETIN

May 1989

Members' Night

Friday, May 5

Field Museum of Natural History Bulletin

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COVER

Costa Rican cloud forest. Photo by Bill Burger. See pp. 8-14

Volunteer at Field Museum

Learn something new or share your expertise—a wide variety of challenging and rewarding volunteer opportunities for either weekdays or weekends are currently available. Please call the Volunteer Coordinator at (312) 922-9410, extension 360, for more information.

MEMBERS' NIGHT

Friday, May 5
5:00-10:00pm

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EVENTS

World Music Programs

Weekends in May
1:00pm and 3:00pm

Program Highlights include:

☐ *May 6 and 7*
1:00pm—Chinese Music Society of North America demonstrates instruments from the Chinese orchestra
3:00pm—Shanta tells African stories and plays African instruments

☐ *May 13 and 14*
1:00pm—Douglas Ewart plays Japanese bamboo flute
3:00pm—Darlene Blackburn demonstrates African dance

☐ *May 20 and 21*
1:00pm—Chicago Beau plays blues harmonica
3:00pm—Fan Wei-Tsi demonstrates the sheng, a Chinese zither

☐ *May 27 and 28*
1:00pm—Musa Mosley demonstrates African drumming
3:00pm—Librado Salazar plays classical guitar

The World Music Program is supported by the Kenneth and Harle Montgomery Fund and a CityArts grant from the Chicago Office of Fine Arts, Department of Cultural Affairs.

Darlene Blackburn

Weekend Programs

EACH SATURDAY AND SUNDAY you are invited to explore the world of natural history at Field Museum. Free tours, demonstrations, and films related to ongoing exhibits at the Museum are designed for families and adults. Listed below are some of the numerous activities offered each weekend. Check the activity listing upon arrival for the complete schedule and program locations. The programs are partially supported by a grant from the Illinois Art Council.

May 6 — 1:30pm *"Tibet Today"* and Tour of Collection.
See Lhasa and other towns now open to tourists, and examine important Buddhist sites during this slide lecture and tour.

May 6, 20 — 12:30pm *"Museum Safari."*
A trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon and an Egyptian tomb, big game from Africa, and seals from the Arctic.

May 20 — 1:30pm *"Tibet Today and A Faith in Exile."*
This slide lecture focuses upon Tibetan refugees in India: Dharmsala, Darjeeling, and Sikkim, and includes slides of the dedication ceremony of a Himalayan Buddhist *chorten* by His Holiness the Dalai Lama.

These programs are free with Museum admission and tickets are not required.

Raices del Ande will perform Latin American music for Members' Night visitors

38th Annual Members' Night

Friday, May 5
5:00 - 10:00 P. M.

Join us for Members' Night at Field Museum and visit with our curators, preparators, researchers, and educators and find out what they know and are in the process of learning. Ask questions, participate in hands-on activities, and explore all the Museum's usual off-limit areas. This is your chance to visit with the staff who created "Inside Ancient Egypt" and learn about "Traveling the Pacific," our new hall opening in November. Find out what goes on behind the scenes at Field Museum to generate new exhibits and programs as well as about scientific research.

Musical entertainment will include the "Gillan School of Highland Dance," "Raices del Ande" performing Latin American music, and "Ars Subtilior" performing music from the Middle Ages and Renaissance.

Come by car and park free of charge in the Museum's parking lots or Soldier Field lot. Simply show your member card or Members' Night invitation.

Free bus service will operate between the Loop and our south door. These Willett buses, marked "Field Museum," will originate at the Canal Street entrance of Union Station (Canal at Jackson) and stop at the Canal Street entrance of Northwestern Station (Canal at Washington); Washington and State; Washington and Michigan; Adams and Michigan; Balboa and Michigan. Buses will begin running at 4:45 P.M. and continue at approximately 20-minute intervals until the Museum closes at 10:00 P.M. You may board the free "Field Museum" bus by showing your member card or invitation.

Members are invited to bring family and up to four guests. Special arrangements for handicapped persons can be made by calling 922-9410, ext. 453 beginning April 24. "Behind-the-Scenes" activities will end at 9:00 P.M. Don't miss Members' Night at Field Museum—the smart way to have fun!

We Did It For You—

. . . . Our wonderful members and the hundreds of thousands of visitors who pass through our portals each year. Now you can see the beautifully restored and refurbished Stanley Field Hall.

With the completion of a new exterior skylight, which has stopped the years of water intrusion and subsequent damage, follow-up projects were initiated. We proceeded by structurally replacing the bad ceiling, plaster, sconces, Greek motif and floral panels. The final painting of the entire hall has also been completed.

Our heartfelt thanks to all the donors who made this possible. Our gratitude, as well, to the contractors who completed the projects within the constraints of time and budget.

—Norman P. Radtke, Facility Planning and Operations

Henry Hering's sculpture "Research," in the southwest corner of Stanley Field Hall, gets a blast of fresh paint by Steve Skupien, while his partner, Andy Hart (left) works on the wall. Foreman Jim Sokolowski (lower right) steadies their stage with a guy rope. Their firm, National Decorating Service, Inc., repainted the entire interior of Stanley Field Hall.
Dave Walsten

Coyote
Serigraph, 22" × 30"

COYOTE: A MYTH IN THE MAKING

Contemporary Native American art

April 8 to July 9

"Coyote: A Myth in the Making" presents the paintings and sketches of contemporary Native American artist Harry Fonseca. The exhibit focuses on Fonseca's vision of Coyote, a magical being prominent in the traditional literature and religious beliefs of many Native American cultures. The exhibit traces Coyote's history as he emerges from Fonseca's Maidu heritage and leaves the reservation to participate in many facets of American life.

A Gift from California
Serigraph, 22" × 30"
A Gift from California presents Fonseca's assertion that the Indian culture of California was alive and very different from that of the Southwest. The serigraph illustrates a women's dance, which honors both the acorn and women as givers of life; the four dancers carry burden baskets filled with acorns, a traditional staple of life for the Maidu and a symbolic representation of Maidu culture. The traditional Maidu basket designs are, left to right, winged lightning, angleworm, quail plume, and ants on a log.

Bill Burger

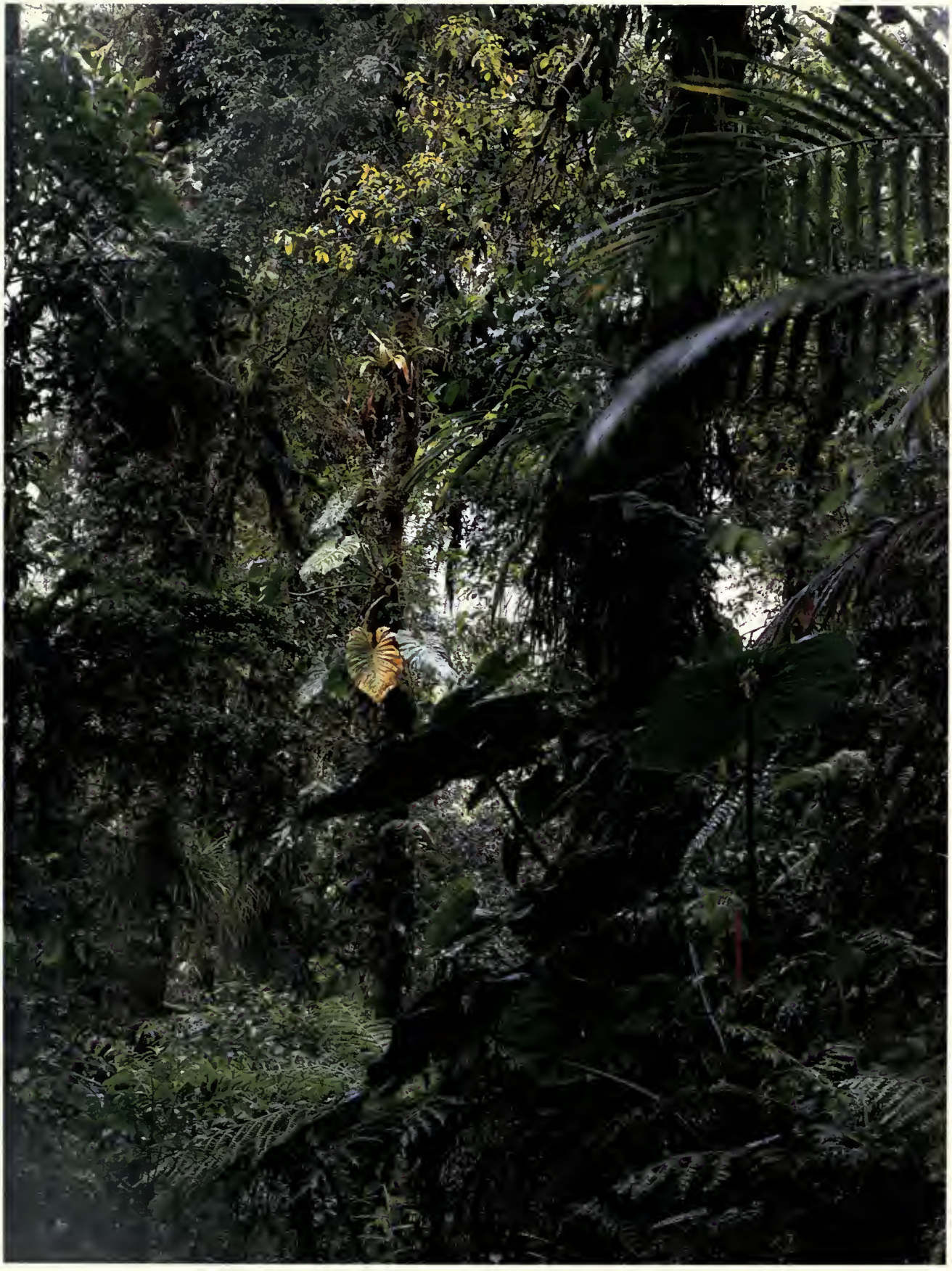
RAIN FOREST PRESERVATION CONFERENCE

Sunday, May 7, 2:00 P.M.
James Simpson Theater

The biological diversity and importance of tropical rain forests and how Chicagoans can protect and preserve them will be the topic of a major conference to be held Sunday, May 7, beginning at 2:00 P.M. in James Simpson Theater. Moderated by WBBM-TV Channel 2's anchor Bill Kurtis and sponsored by the Chicago Rain Forest Action Group, the conference will bring together biologists, botanists, ornithologists, and ecologists to speak on the need to conserve the world's rain forests.

The program is free and geared to the general public. Presentations will be made by renowned rain forest biologist Dr. Allison Jolly of Princeton University ("Hanging on By the Tip Of Your Tail: Rain Forest Mammals"); Dr. Bill Burger of the Field Museum ("Tropical Forests: Engines of Biological Diversity"), Dr. Patty McGill-Harelstad, curator of birds at the Brookfield Zoo ("Rain Forest Birds"); and Dr. Monte Lloyd, ecologist from the University of Chicago ("Endangered Species, Endangered Peoples, Endangered Climate, and Endangered Agriculture: What Can We Do?"). A special presentation will be made by Mario Boza, executive director of Costa Rica's Fundacion Neotropica and one of the guiding forces behind Costa Rica's national park system ("The Costa Rican Conservation Program").

The conference is the kick-off event of the Chicago Rain Forest Action Group (CRAG), which is working to educate the public on rain forest issues. CRAG is currently raising funds to assist the Costa Rican National Park Service in protecting and expanding the Corcovado National Park, a tropical rain forest preserve. Jay Horberg, CRAG President, explains that "the issue of rain forest destruction is one we cannot ignore. Every acre of lost rain forest leads to the extinction of undiscovered and unstudied plant and animal species, and contributes to the greenhouse effect. We must take action because the atmosphere belongs to all of us. Tearing down and burning precious forestland for cattle grazing and agriculture is a shortsighted policy that Chicagoans can and must fight." The conference will begin at 2:00 P.M. and run until 4:00 P.M., with a period thereafter for the public to meet the speakers. Entry is through the West Door. Refreshments will be served.



Tropical Forests and the Number of Plants and Animals On Planet Earth

by William Burger
Curator of Vascular Plants
photos by the author

Our world is the home of a plentitude of different animal and plant species. They vary in size and structure from microscopic bacteria to whales and giant redwoods, from fleas to fish and flowers. Despite the ravages of disease, predation, drought, flood, famine, and fluctuating climates, planet earth supports millions of different kinds of organisms.

A little-appreciated aspect of this abundance is how much of it is found on land.

Despite their vastness (more than 70 percent of the earth's surface) and depth, the world's oceans do not support nearly as many species as does the land surface. It seems likely that the number of named plants and animals living in all the world's oceans roughly equals the number of named beetles, most all of which live on land. And if you argue that there are many undiscovered little critters living deep in the ocean bottoms, one can counter that there are enough undescribed beetles in the high canopy of the world's rain forests to match that number. Of all the different habitats on land, tropical forest communities harbor the vast majority of species.

Why is it that tropical forests are the home of so many different species? Part of the explanation is the wide separation of different tropical forest regions from one another on the surface of our planet. Latin America, Africa, southern Asia, Australia, and the oceanic islands are isolated from each other, and all have their own distinctive faunas and floras. Though they do share a relatively small number of widespread cosmopolitan or pantropical species, the large majority of species in each area is found nowhere else. However, even within a single tropical region the richness of species is far greater than what we find in our north-temperate areas. What is it about these tropical regions that allows them to support so many species?

Some people have the misconception that the tropics are without seasons, and that their natural vegetation is something called "jungles." The reality of tropical nature is far more complex. In lands where there are no cold seasons there can be severe dry seasons; it is the length of the dry season that determines whether the local vegetation is desert scrub, thornbush, rain forest, or something in between. There are some tropical regions without a stressful dry season, and these support what we call rain forests or cloud forests. The length of the dry season and overall rainfall are the primary factors determining local vegetation and forest distribution.

Just as in our winter season, plants must become dormant to survive a long dry season. Consistent patterns of hot temperatures and low rainfall support desert, grassland, and thorn-scrub communities. If the wet season is short, there is not enough time to produce new foliage, to flower, to fruit, and to build a large plant body. Subdesert grasslands and thorn-scrub are characterized by small tough plants. Like the tundra, thornbush and grasslands are a reflection of a severe environment.

The maintenance of tropical forest vegetation requires a reliable rainfall during the wet season. The transition from a low thorn-scrub to a deciduous wood-

⇦ Broad openings in the forest canopy bring light to the lower parts of this cloud forest. Tapanti, Costa Rica.

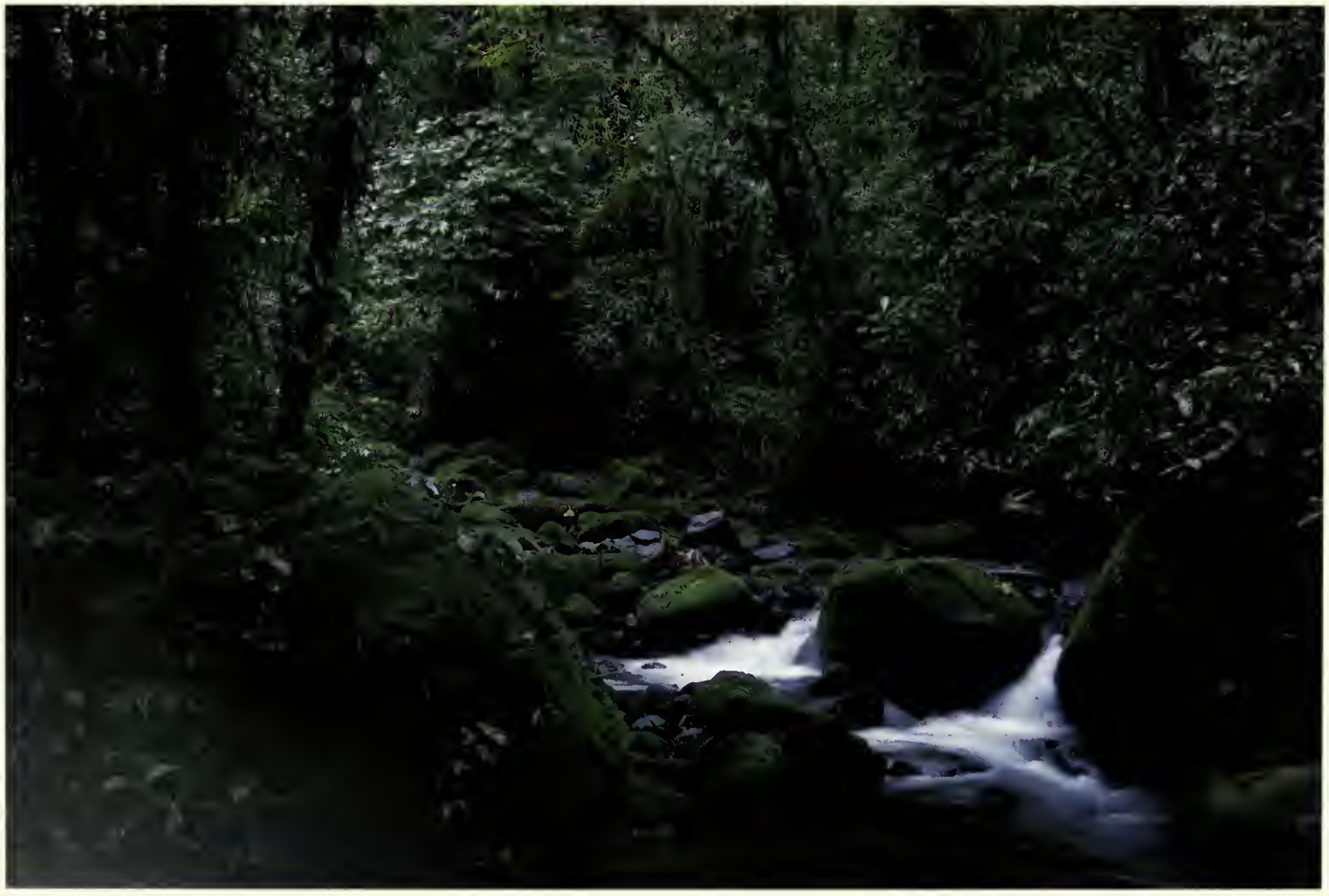
land of small trees begins as the wet season reaches about 500 mm (20 inches) of rain per year. As the rainfall increases and the dry season shortens, the height of the forest increases. A wet season with a full meter (39 inches) of rain a year can support a forest with trees over 60 feet high, but most of the trees will lose their leaves during the dry season. These deciduous forests may resemble our own temperate forests in the height and form of the trees.

As the rainfall further increases the forests change from deciduous to evergreen and the treetops reach 150 feet in height. These evergreen "rain forests" support the richest assemblage of species found in any biome on earth. With moisture and warmth throughout the year, and with habitats ranging from the dark forest floor to the sunny high canopy, the lowland rain forest is the most luxuriant example of life on earth. Such forests can support between 300 and 400 different species of large trees in the same small tract, and the numbers of insect species these trees harbor must number in the thousands. No other habitat, not even the coral reef, can support as many coexisting species as the lowland rain forest.

The small deciduous woodland, the deciduous broad-leaf forest, and the tall evergreen rain forest differ in stature and percentage of deciduous plant species. They also differ in the species themselves. Few rain forest plant species are also found growing within the deciduous forest. Likewise, most plant species of the deciduous forest are confined to seasonally dry areas. Here we find another important reason for tropical species richness: different types of forests support a host of different plant and animal species.

But rainfall is not the only important factor affecting tropical forest vegetation: temperature is another. This may surprise those who think that the tropics are

Large displays of flowers are rarely encountered in tropical rain forests where species can flower any month of the year. Reserva Forestal de San Ramon, Costa Rica.



A short deciduous woodland and thorn bush cover the drier rocky slopes, while acacia trees flower in the taller floodplain forest. Ogaden region, Ethiopia.

always hot. True enough, if you remain in the lowlands, but conditions change as one ascends the mountains. Average temperatures decrease regularly as altitude increases. For example, at 2,000 meters elevation (6,500 feet, slightly higher than Denver) afternoon highs average between 70 and 80 degrees F, with nighttime lows dropping into the 50's.

Many higher elevation forests are cloud forests. Warm winds, forced up the mountainsides, cool, lose their ability to hold moisture, and form misting clouds over the forest. The cooler overcast conditions allow air-plants, or epiphytes (plants that use other plants as a support), to grow high among the branches of the trees. The strong winds and weight of the epiphytes cause many branches to break, with the result that the cloud forest is not as tall as a lowland rain forest, and there is more light on the forest floor below. While there may be as much rainfall in montane cloud forests as in the lowland rain forests, the two forest types are very different in structure, climate, and species composition. Cloud forests are where epiphytes achieve their greatest numbers. Orchids, bromeliads, ferns, and mosses festoon the branches of trees in this cool and misty world.

Higher up the mountains (between 2,000 and 3,000 meters), the forest changes yet again. The cooler nights reduce the number of species that can compete in these forests and it is not uncommon to find dominant species of trees, something rarely encountered in the lowlands. The cooler temperatures of higher elevations are reflected in the smaller size of leaves and decreasing stature of the forest. In addition, the thinner air is a bit drier and mosses and lichens become the major epiphytes. At elevations above 3,000 meters (10,000 feet), night-time temperatures can regularly fall below freezing. These high mountain habitats

have been described as "summer every day and winter every night." At these higher elevations, tall montane forests give way to elfin forests. And finally, above about 4,000 meters (13,000 feet), trees can no longer survive and alpine/paramo vegetation predominates.

Just as in the contrast between thorn scrub and deciduous broad-leaf forest or evergreen rain forest, the types of forest found at the different altitudinal levels are composed of different species. It is unusual for a plant species to have an elevational range of more than 5,000 feet (1,500 meters). The trees as well as understory shrubs and high epiphytes are very different in a forest at 3,000 feet elevation and in a forest at 8,000 feet. There are other factors as well; steepness of slope, the exposure to wind, and the length of the dry season can produce very different kinds of forests on these higher mountains.

What all these diverse ecological factors add up to is the simple observation that there is no such thing as a "generic tropical forest." Soil conditions, flooding, and many other factors also affect forest structure and composition. Every local region differs in subtle ways from other nearby regions, and the stature and composition of the local forest biota will reflect these differences.

Tree ferns often grow on steep open slopes in lowland rain forest formations. Golfito, Costa Rica.

Simply stated, the primary reason for tropical species richness is that there is such a variety of different tropical vegetation types.

A great many species of the tropics are what we call specialists: plants and animals found in only a specific habitat, or associated with specific hosts. For plants that cannot move (once they germinate and begin to grow) specialization is more the rule than the exception. Many plant species are found only in particular kinds of forests, or at particular altitudinal levels. Many insects and smaller animals are similar in being limited to specific forest types. The larger mammals are quite different. You can expect to find Baird's tapir on Costa Rica's highest mountain as well as in lowland rain forest or deciduous forest. Likewise, in East Africa the elephant, the cape buffalo, the leopard, and many other larger animals can be found in the highest montane forests as well as in savannas of the hot lowlands. Very few species of plants and small animals are so versatile.

In addition to habitat specialists, tropical biotas have many species of limited geographical distribution. A cloud forest on the top of one volcano in Central America will often have a number of species not found on any other volcano, even when the forests and climate appear to be identical. These local species not found anywhere else are call *endemics*. Because tropical forests have so many species of limited distribution, destruction of any larger forest area is likely to cause the complete extinction of some species. If we lost all our forest species in Illinois, not a single species would go extinct; because all of these species grow in other areas of the Midwest. If little Costa Rica lost all its forests there would be a very different result: between 1,000

Frequent clouds and misting keep the montane cloud forest cool and damp. Reserva Forestal de San Ramon, Costa Rica.

An afternoon thunder shower brings moisture and cooler temperatures to a lowland rain forest. Bri Bri, Costa Rica.

and 2,000 species would never be seen again. We do not know why so many species have differentiated within tropical forests or why so many have such limited ranges, but the consequences of tropical forest destruction are clear: many species will be lost forever.

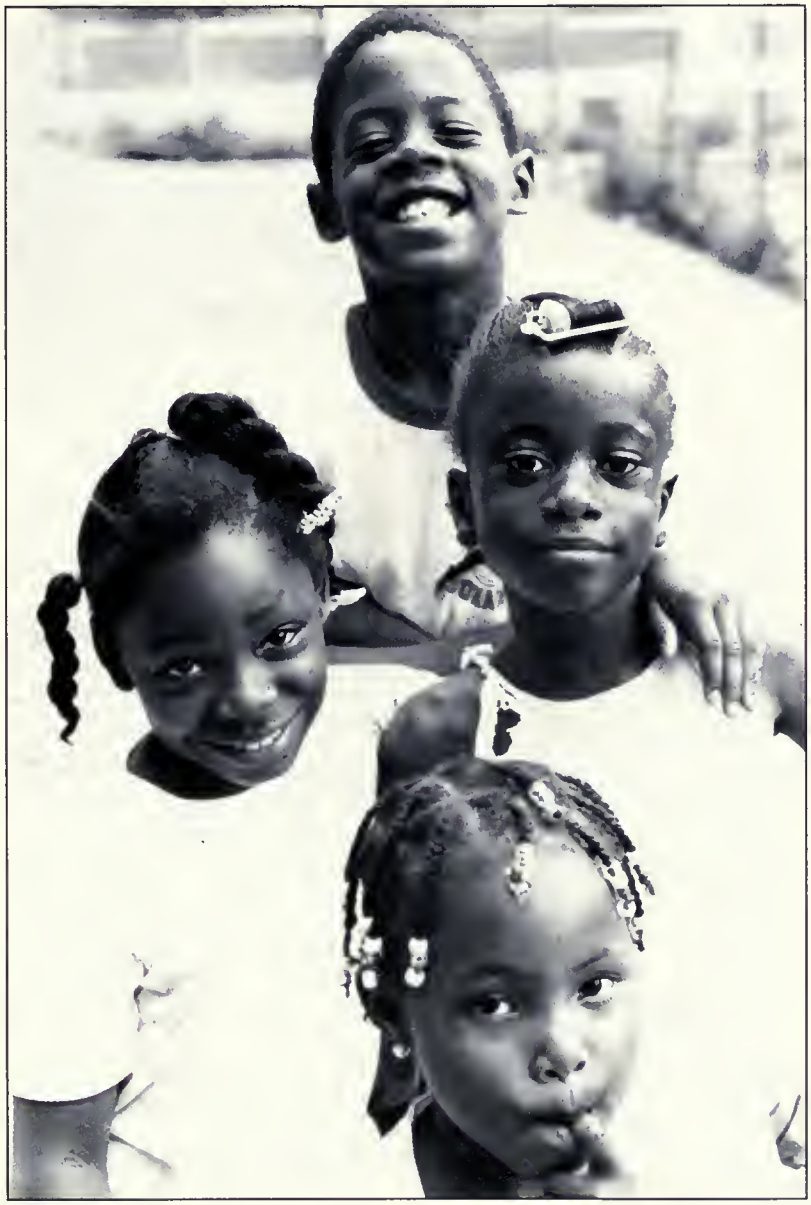
Throughout the tropics, forests are being destroyed at an accelerating rate. Timber production is one aspect of forest degradation, but the major factor is clearing of forest and woodland to expand agricultural production. Whether this is done by local subsistence farmers to expand their meager crops, or by large companies expanding pastures for beef production, the effect is the same and cumulative. With the world's human population still growing by almost 100 million a year, and with most of this increase taking place in the warmer regions of the world, tropical deforestation will continue.

The challenge for preservationists is daunting. Hopefully, smaller areas with unique biotas can be preserved in special parks and preserves. But to maintain larger tracts the forest will have to become an integral part of the local or regional economy. Developing economically viable sustained-use forestry programs, before these tropical forests are destroyed, is one of the major challenges of our day. It will take everyone, from land-use planners and ecologists to local politicians and investment bankers, to devise intelligent long-term solutions for the problem of tropical forest destruction. **FM**

Changing Chicago: Cultural Diversity

Photo Exhibition

April 22-September 4



Marc PaKempner

THE ESSENCE of Chicago's diverse communities emanates from the still photography of six area photographers on display from April 22 to September 4, 1989. "Changing Chicago: Cultural Diversity" is one of five simultaneous exhibitions in Chicago organized by the Focus Infinity Fund. Field Museum's exhibit includes more than 100 black-and-white and color photographs by Dick Blau, Kerry Coppin, Tom Hocker, Jim Newberry, Marc PaKempner, and Richard Younker. The communities represented through their work include African-American, Polish, and Asian. The photographers participating in Field Museum's exhibition spent a full year documenting the customs, traditions, and values of their assigned communities.

Collecting Small Mammals In the Atlantic Rain Forest of Brazil

By Barbara E. Brown
Technical Assistant, Division of Mammals

photos by author
except where noted

Two kinds of lion tamarins in the breeding colony of the Centro de Primatologia do Rio de Janeiro; in front, the golden (*Leontopithecus rosalia rosalia*); behind, the golden rump (*Leontopithecus rosalia chrysopygus*).

OUR BASE OF FIELD OPERATIONS, October 1987, the Centro de Primatologia do Rio de Janeiro, hardly fifty miles northeast of the coastal metropolis of Rio de Janeiro, nestles serenely in the aptly named valley of the Paradise River at the base of the spectacular Organ Mountains. The 260 hectares (620 acres) of the Centro supports a remnant of the formerly vast and now fast-disappearing Atlantic rain forest. The reserve is still completely surrounded by forest, much of it, however, secondary. Cultivated fields, pastures, and farm houses are in the deforested valley lower down. Dr. Adelmar F. Coimbra-Filho had invited Curator Emeritus of Mammals Philip Hershkovitz and me to the Centro to carry on the survey of small mammals of eastern Brazil Phil had been making in collaboration with the National Museum of Brazil and the University of Brasília. Marcelo Lima Ries, a graduate student majoring in mammalian ecology at the university, participated in the survey. Lourenço, foreman of the Centro and an able woodsman, was placed at our service by Dr. Coimbra-Filho. Dr. Pissinati, assistant director and veterinarian of the Centro, was always on call for help in resolving any logistical problem that might arise.

The Monkeys

The forested surroundings of the guest house where we were quartered and the Organ Mountains that rise to over 2000 meters above the Centro were known to be the home of several species of monkeys peculiar to the Atlantic forest. We soon learned, however, that the once-plentiful muriquí, or wooly spider monkey (*Brachyteles arachnoides*), largest of New World monkeys, had been exterminated years ago throughout the state of Rio de Janeiro. The golden lion tamarin (*Leontopithecus rosalia rosalia*) had been hunted and trapped for the pet market until no more remained free in the state. We neither saw nor heard in the wild any of the other kinds of monkeys. A few residents mentioned having heard the brown howler monkey (*Alouatta fuscus*) call in distant hills. The large squirrel-like titi monkey (*Callicebus personatus*) may have disappeared entirely from the vicinity of the Centro, and the usually ubiquitous marmoset (*Callithrix aurita*) was nowhere visible.

In the Primate Center breeding experiments are conducted with captive representatives of these and other species of endangered and disappearing monkeys. The time is at hand when some of the animals will be reproducing in sufficient numbers to permit their gradual introduction into government-controlled parks and reserves where the species existed before.

Small Mammals

Our mission in the Atlantic forest was not with monkeys or other comparatively large, conspicuous mammals. We came to observe in the field, and to collect for laboratory study the small, nocturnal, cryptic marsupials, bats, and rodents. These are at once the best and most readily available indicators of mammalian history and biogeography; some are closely associated with man and important in his welfare. Our primary pur-

pose, Phil explained, was to make an inventory of the species, discover their habitats, and then try to unfold the mysteries of their being before they, too, like the monkeys, disappeared with the vanishing forest. At the same time, Phil was committed to training and teaching mammalogy to young qualified Brazilians so that they might carry on the work of conservation and management guided by an intimate knowledge of the animals themselves.

Trapped four-eye brown opossum (*Metachirus nudicaudatus*).

Trapping

Learning about small nocturnal mammals in the wild begins with live-trapping them in their home range. The productive part of the workday, therefore, starts with setting traps, an occupation that engages the entire afternoon. Our 200 live and 100 snap traps were set in lots of 10, usually 20 to 40 in any one trapline. At first, the four of us worked together until we learned Phil's trapping and baiting methods. The first lines were set nearest headquarters in wooded hillsides, forest edges, and in and along swiftly flowing rock-strewn streams. From there we worked out individually or in pairs to more distant sites as far as we could until nightfall. As a rule, traps were picked up after three days and reset elsewhere both within and beyond the confines of the Centro.

Setting out to trap small forest mammals.

Pasture, once lush tropical forest, at the base of the Organ Mountains where the road nears the Centro de Primatologia.

Inescapably, we worked during the highest heat of the southern latitude midsummer day; but trapping in the shade of the forest was a gratifying escape. At times, however, we had to reach distant forested hills by fording streams and crossing mile-wide pastures. The cattle we passed taking their siesta in the shade of scattered trees would idly turn heads toward us and stare as we marched past under the full glare of the sun, each of us loaded with traps, bags of bait, and drenched by sweat pouring from our brows.

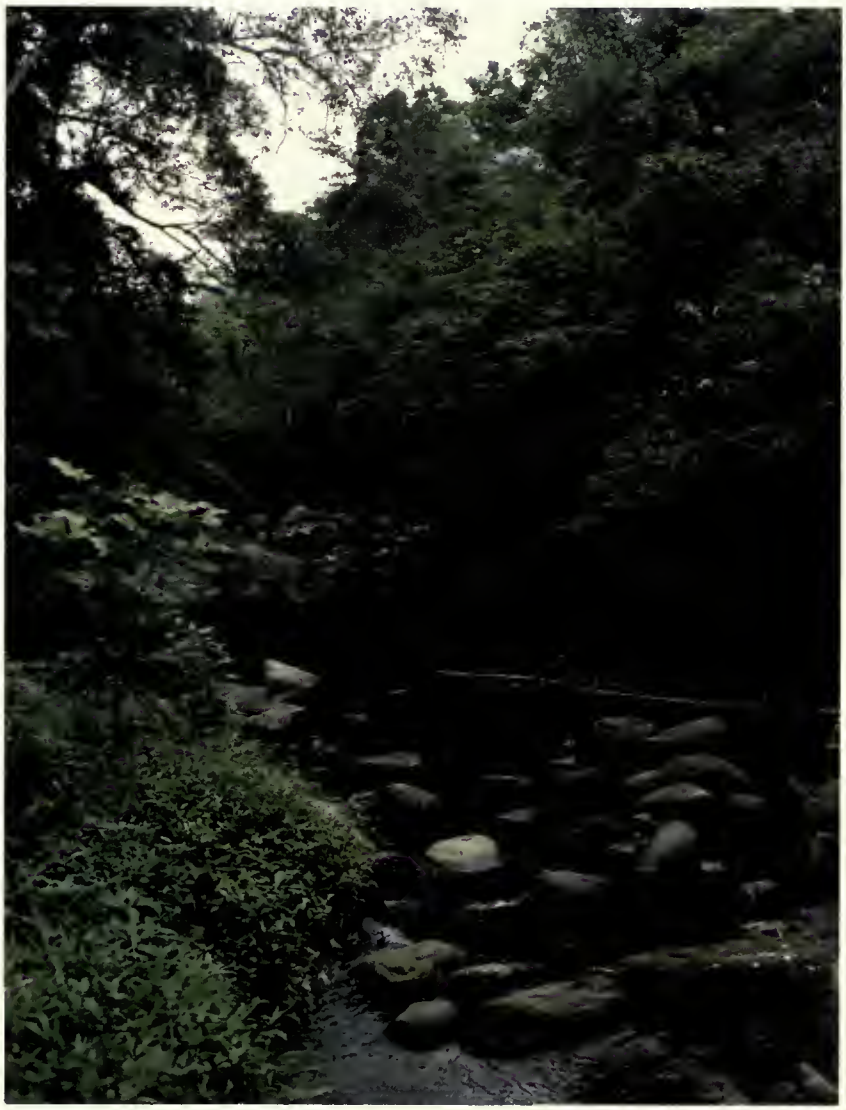
Bait was ripe bananas, peanut butter, oatmeal, corn, rice, and manioc, used alone or in various combinations. Rodents took everything. Marsupials preferred banana and peanut butter, but so did ants and other foraging insects. We baited the traps late in the day to give crepuscular and nocturnal mammals a chance at the food before the insects consumed it or rains washed it away. In any case, bait doesn't last long in tropical heat and must be replaced every one or two days.

For diversity of catch, traps were set in every habitat type, whether on and above the ground, in forests, thickets, forest edges, open fields, streams, cultivated fields, abandoned banana and manioc patches. We soon learned that the little forest animals we sought were not active during the day and that they shunned clearings converted to pasture or left fallow. Secondary

Four-eye gray opossum (*Philander opossum*) on its way to escape.

grass and scrublands that overran deforested areas are often, or in time, invaded by native nonforest mice from bordering savannas.

Most of the arboreal mice and opossums we trapped favored old abandoned banana orchards choked by second growth. As expected, water rats and water opossums were captured in and along streams. Long-nose mice of the genus *Oxymycterus* were taken only in tall forest. Curiously, these mice were hardly distinguishable from another species of the same genus collected the year before by Hershkovitz in the natural tall grass savanna, or *cerrado*, of central Brazil. These and the other species of *Oxymycterus* are currently being studied by Associate Curator Bruce Patterson, head of the Division of Mammals.



Rocky stream habitat of water rats and water opossums.

Bats

Certain kinds of bats can be easily collected in their roosts during the day. Caves, tree hollows, culverts, tunnels, and buildings are common daytime habitats. The vast majority of bats, however, hide during the day in protected places not easily recognized or accessible to humans or other predators. To catch flying bats at night, we stretched fine-mesh nylon nets made in Japan across flyways, streams, and other places where bats were seen foraging. Fruit-eating bats were most frequent victims of the nets. Insectivorous bats, with a much more acute sense of echolocation for prey detection and obstacle avoidance in flight, rarely crashed the nets.

Wild-living adult wooly spider monkey (*Brachyteles arachnoides*) photographed by a São Paulo Zoo staff member in one of the few natural habitats remaining in São Paulo State. Courtesy São Paulo Zoo.

Evenings were cool. After I and the others plucked the mites and ticks picked up by our bodies during the day, and after a refreshing cold shower, we relaxed with a delicious meal prepared by chef Philip. Evenings were devoted to writing up observations of the day and discussing plans for the next. We retired for the night with lingering thoughts of what the traps would hold next day.

Preparation and Preservation

Up before dawn for an early breakfast and visit to the traps, I to my traplines, each of the three other members of the team to theirs. Bat nets hung the evening before were inspected, usually by Marcelo, and relieved of their catch, if any. The nets were then lowered for the day, or removed for hanging elsewhere. Unproductive traplines were also picked up for placement in preselected habitats. Captured animals were brought to headquarters, the bats in a bag, the others in their traps. These operations consumed the entire morning. After lunch, the animals were checked, the live ones sacrificed. Each was numbered, measured, weighed, examined for embryos or reproductive state, parasites removed for preservation in alcohol. The data were recorded in field catalogs and notebooks. Preparation and preservation of each specimen included skinning in a special way, stuffing the hide with cotton, tagging with number and date, and pinning down on fiberboard to dry. Skeletal material was cleaned and hung out to dry; entire animals and selected carcasses and organs were preserved in a mixture of alcohol and formalin. During the hours of preparation Phil addressed questions generated by our work, discoursed on mammals in general, and on our scientific objectives in particular.

When and Where

Marsupials, we were told, were in South America since or perhaps before the continent split off from Africa 80 or 90 million years ago. After a long period of dominance, only the smallest, more primitive or more generalized species among the marsupials survived to this day and now abound in the Atlantic forest. Very little is known of the history of bats but they could have been in South America as long as any other placental mammal. There seemed to be fewer bat species here than in the equatorial forests. Two of the three major groups of South American rodents are well represented in fossil records. Squirrels, abundant now in South America, left no fossil record on the continent. The group known as spiny rats and relatives appeared in South America at least 30 million years ago, or about the same time as the South American monkeys. Some scientists argue that they were already on the continent when it began to drift away from Africa. Field mice and forest mice, collectively sigmodontines because of the

A breeding colony of marmosets (*Callithrix jacchus*) of the Centro de Primatologia.

Peaks of the Organ Mountains above the Centro de Primatologia; coastal plain in background.

shape of the crowns of their molar teeth, are known from fossils no more than about three million years old but the actual time of their arrival in South America is controversial. Some biogeographers say the mice came from Central America when the connection with South America was formed less than 3,000,000 years ago. Others claim that the sigmodontine mice came from Africa with the monkeys on the drifting continent. In any case, they are now the dominant mammals of tropical America in numbers and kinds. Few of them are well known, many others are believed to be unknown to science. The Atlantic forest has a large number of species peculiar to the region. More are being discovered as fruits of our work.

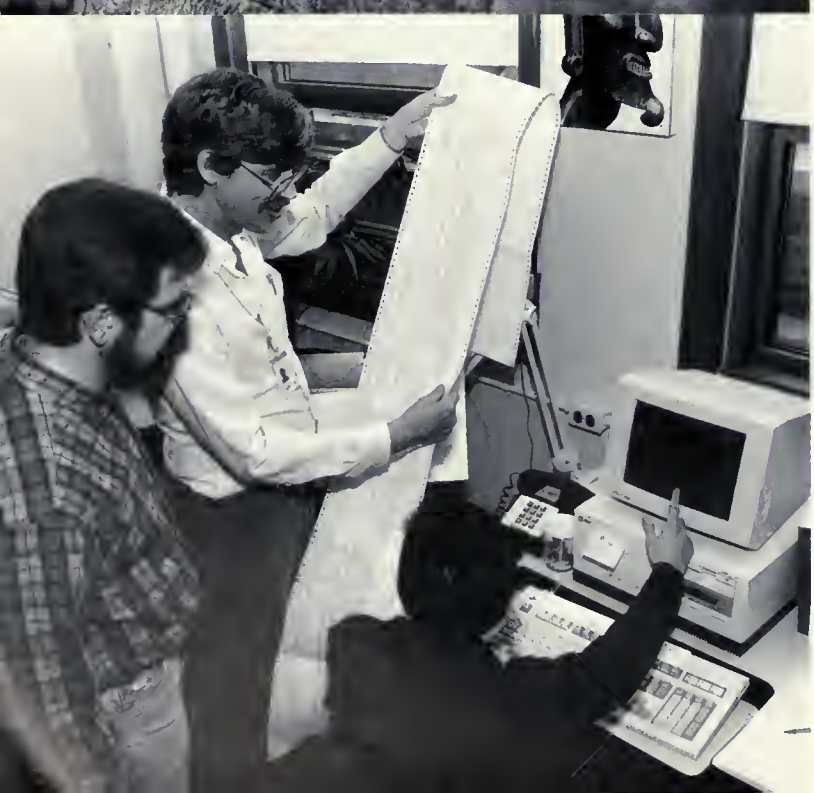
Water rat (*Nectomys squamipes*) captured near the Centro.

Importance

These small living descendants of the mammals of the geologically oldest parts of South America must be studied to learn where the Atlantic forest mammalian fauna originated. Scientists also want to know how and where they diversified and dispersed and their relationship to living and extinct animals of other parts of the world. They are also concerned with their present status for survival; their interaction with man in some ways known to be benign, in others harmful, but in most ways still conjectured.

The Experience

About 150 small mammals represented by rodents, marsupials, bats, and rabbits were collected in the three-week period. Our field work terminated 15 November 1987. After 18 years of assisting Phil with his research in the Museum, and typing his scientific papers, field notes and diaries, I learned first hand what field work was all about. None of this would have been realized without the hospitality and cooperation of Dr. Coimbra-Filho, director of the Centro de Primatologia do Rio de Janeiro, and his supporting staff. **FM**



A Day in the Life Of the A. B. Lewis Project: The Legend Lives

New Guinea photos by A. B. Lewis
Present-day lab photos by June Bartlett

In the spring of 1909, Albert B. Lewis, then assistant curator of Melanesian ethnology at Field Museum, set off on a research odyssey to Melanesia that would keep him overseas for nearly four years.

By the time he returned to Chicago in 1913, Lewis had collected more than 12,000 artifacts for Field Museum, including masks, carvings, and other ritual objects, as well as bowls, knives, headrests, pots, and clothing used in daily life. Lewis acquired many examples of the same kinds of artifacts to illustrate the rich variety he observed in the designs and forms of Melanesian objects.

Today, using modern research methods and technology, we are reexamining this world-renowned collection brought back to Chicago more than 75 years ago. The research directors of the A. B. Lewis project, Research Associate Robert L. Welsch and Curator John E. Terrell, are attempting to unravel how trade and communication using outrigger canoes influenced people's lives on New Guinea's north coast. Since January, the A. B. Lewis Memorial Laboratory at Field Museum has witnessed constant activity: studying the collection, photographing artifacts, and preparing for field work in Papua New Guinea by Welsch and Terrell later this year.

Other members of the project's research team are Deborah Beckles, James Coplan, Ralph Cowan, Josephine Faulk, Ann Gerber, Barbara Hsiao, Phillip Lewis, Abigail Mack, Sam Mayo, John Nadolski, and Caroline Price. Funding for the project has come from Field Museum, the Thomas J. Dee Fund, Walgreen Company, School of the Art Institute of Chicago, Northwestern University, the National Science Foundation, and private donors.

Photos (clockwise from right): James Coplan compares regional designs on bone daggers and rests; Josephine Faulk and Robert Welsch map trade networks; washing sago, Sissano, 1909; Josephine Faulk, Caroline Price, and Abigail Mack compare motifs on carved bone daggers; John Nadolski, Robert Welsch, and Barbara Hsiao analyze computer data; man adorned for dance, Sisimongum, 1910.
New Guinea photos: 31862, 31880, 33508 Bartlett photos: GN85336

PLANT COLLECTING IN PALAWAN

By Djaja Djendoel Soejarto

Photos courtesy of the author

Western coastal slopes of Irawan mountain complex.

PALAWAN IS A SOUTHWESTERN ISLAND PROVINCE of the Philippines, the fifth largest in this country of more than 7,000 islands. It is located about 100 miles north of the tip of Borneo, has an area of some 4,500 miles (slightly smaller than Connecticut), and is about as far north of the equator as Costa Rica (8°-12°). It consists mostly of mountain ranges, notably the Mt. Mantalingajan Range at the southern end (highest peak 2,085 m), the Victoria Range (1,798 m) to the north of it, and the Cleopatra Range (1,593 m) next. The Cleopatra Range gradually descends northward into the Pagdanan Range. Another, lower range is at the island's far northern end.

Because of Palawan's mountainous character, the flat lowlands are limited to alluvial strips (silt, sand, and gravel left by streams), mostly on the eastern side. Good forest cover is still to be found over most of the

Dr. Djadja Djendoel Soejarto is a research associate in the Department of Botany and associate professor of Pharmacognosy, College of Pharmacy, at the University of Illinois at Chicago.

island, though this is being depleted at an alarming rate. Palawan's floristic richness—that is to say, the wealth and diversity of its plant species—qualifies the island as the Philippines' last frontier of wilderness as well as a tropical rain forest reserve. The island's flora bears close relationships with that of Borneo as well as with the more northerly Philippine floras, and it holds an important key to understanding the history of plant distribution in Malesia, that region between and including Malaysia, the Philippines, Papua New Guinea, the Bismarks, and Indonesia. The economic potential of Palawan's rain forests as a source of timber, foodstuffs, and other forest products (cane, gums, resins, etc.) was brought to light by a Swedish expedition in 1984. Its medical importance, however, has until now been ignored.

Tropical Rain Forests and Medicine

Tropical rain forests may contribute to medicine in three ways: They may directly provide pharmaceutical products, such as plant extracts and pure chemical compounds; they may serve as models for chemical synthesis of related medicinal compounds; and they may provide investigative, evaluative, and other research tools in drug development and testing.

Many of our most important plant-derived medicinal compounds come from tropical species. Notable among such compounds are vincristine and vinblastine (from *Catharanthus roseus*), used in the treatment of cancer; quinine, used to treat malaria, and quinidine, to control heart arrythmias (both from *Cinchona ledgeriana*); the contraceptive diosgenin (*Dioscorea* species); the local anaesthetic cocaine (*Erythroxylum coca*); reserpine and deserpidine (*Rauvolfia* species), used as tranquilizers and to control high blood pressure; castor oil (*Ricinus communis*); and the heart stimulant ouabain (*Strophanthus gratus*). Thus, the possibility exists that additional medicinal compounds remain to be discovered among the still unknown plants in Palawan's rain forests.

Since the importance of Palawan's forests as a medicinal resource has not been explored, I traveled to Manila in July of last year to collect plants in Palawan for anti-cancer and anti-AIDS screening, under the auspices of the United States National Cancer Institute. This field work was carried out between July 12 and August 23 jointly with Dr. Domingo A. Madulid, botanist at the Philippine National Herbarium, National Museum, Manila, with the assistance of Ernesto Reynoso and Epifanio Sacgal, herbarium technicians at that museum.

Our collecting was slightly different from the kind one usually hears about—collecting herbarium specimens for botanical study. Actually, we did collect herbarium specimens for this purpose, but only secondari-

The expedition crew having a lunch break. Trident Mining site at the base of Victoria Range. The author is sixth from left.

ly. Much of our work involved locating species already identified. Samples of these (0.3-1 kg dry weight) were collected for the biological tests. To make sure we had identified the plants correctly, as well as provide for future reference needs, additional specimens of the same plants were collected for the herbarium. The identity of these co-called "voucher specimens" was later confirmed or newly determined, and duplicates distributed to other botanical institutions. Collecting such plant samples in the tropical rain forest presents several challenges, such as on-the-spot identification of specimens and logistics. Transportation of bulky parcels, the drying and processing of samples, and air cargo dispatching were major logistical problems.

Modern botanical exploration of Palawan had its origins at the beginning of this century through the work of a number of botanists and collectors, notably the American botanists E. D. Merrill and A. D. E. Elmer. By mid-1980, about 1,500 flowering plant species (649 genera in 138 families) were known from Palawan, of which 5 to 15 percent were believed to be unique to this island. In 1984 a floristically oriented three-month expedition was carried out by Sweden's Hilleshog Forestry, and as a result of this expedition, 153 species new to Palawan—about 10 percent—were added, so that at least 1,672 species are now known to occur there.

Getting to Our Collecting Sites And Expedition Logistics

Puerto Princesa, Palawan's capital, may be reached from Manila by ship (one day) or by plane (2 hours). It is a large city of more than 100,000 people, where many items for our expedition could be purchased and vehicles rented. There is a partially paved road connecting important towns along the east coast, from Brooke's Point, near the southern tip, to Puerto Prin-

Our *Jeepney* negotiating the Irawan River.

cesa, and from Puerto Princesa to Roxas, in the north. This road continues north along the east coast to Taytay and beyond, towards the northern tip; but beyond Roxas it is safely passable only during the dry season (February to May). The west coast may be reached from the east coast at three points.

Along the east coast, limited roads, built by mining and timber concession companies, connect a number of towns with points located at the base of the eastern mountain slopes, such as from Puerto Princesa, from Aborlan, and from Nara. Where these roads start winding up the mountain slopes, they may be negotiated only by 4-wheel-drive vehicles. Few bridges have been constructed, so that motor vehicles usually have to ford rivers and stream beds. Other than by roads, access to forested areas is along forest paths and trails by foot.

Our expedition headquarters was established at Puerto Princesa, from which short trips (3-7 days) were made to various forested regions. Temporary bases, set up in different collecting areas, consisted of tents in the forest, of lodging houses in nearby towns, or of thatched houses near the collecting sites.

Field work mobility was provided by a rented *Jeepney*, a jeep/truck/minibus hybrid specially built for personnel transport. The spacious rear benches could accommodate large amounts of equipment and passengers at the same time, while the high chassis clearance and the powerful engine made it possible to cover terrains otherwise appropriate only for 4-wheel-drive vehicles. Though the *Jeepney* didn't have this last feature, it was able to negotiate the forested and topographically difficult terrains. It was our experience, however, that the *Jeepney* is not the ideal vehicle for such travel during the rainy season.

Health conditions in Puerto Princesa and other large towns of Palawan are generally good, and Puerto Princesa has an adequately staffed hospital. In most towns, running water is available either from private wells or from a municipal system. In smaller villages and in forested areas, water is obtained from rivers and streams. The major infectious disease still prevalent on the island is malaria. With this in mind, we took every precaution to avoid contracting it during our stay.

Given the short time that was available to accomplish all our objectives, and the heavy, almost daily monsoon rains (mostly in the afternoons) during the expedition period, a large field staff, including four worker-tree climbers and a driver-cook, was recruited.

Collecting was done in four main areas: the Irawan River Valley, the Takdua Zig-zag, the Trident Mine area at Victoria Range, and on Tabon Island. Minor collections as part of area surveys for future collecting were also made in the Langugan Zig-zag, Pagdanan Range, and Mt. Bloomfield at St. Paul's Bay. More than 200 species and slightly more than 400 samples of flowering plants were collected altogether. Identification of most of the specimens has now been completed at herbaria of Harvard's Arnold Arboretum, the Philippine National Museum, and the Field Museum.

The Irawan Valley collection site is at the foot of Mt. Beaufort, between 100 and 200 meters above sea level, north-northwest of Puerto Princesa. Although this site is only about 16 miles from the capital city, it took more than an hour to reach because of bad road conditions. The forest road, built by a chromite mining company, is part gravel, part rock, and part muddy tracks. It crosses and recrosses the meandering Irawan River eleven times, and after heavy rains the river is impassable. The vegetation cover of this collecting site is good primary lowland mixed forest, with several subtypes, such as riverine forest, valley floor forest, and rocky slope forest. This part of Palawan appears to receive the most rainfall, with the consequent luxuriant forest cover and species richness.

A special hand-operated chopper was developed for the expedition.

Takdua Zig-zag site is named for the switching back and forth of the paved road as it crosses the eastern slopes of the northern reaches of the Victoria Range. Despite the construction work in putting this road

Colorful nylon net bags of various sizes were used to dry samples.

through, the forests along this "zig-zag" remain well preserved, going right down to the sea in some places. The valleys and slopes are covered by tall mixed forest, the ridges by a lower forest.

The Trident Mine site at Victoria Range (50-200 m altitude) is located near the Trident or Bloomfield mining area, along the Victoria Range's eastern slopes. Collecting was done in a flat alluvial plain, forested river banks, and in the more luxuriant forests along the slopes.

The Tabon Island site is on Tabon, a small island off the coast of Quezon town. It consists of a limestone formation at an elevation of about 200 m, with almost vertical cliffs. The forest cover on the sea side goes straight down to the sea, the one facing Palawan Island gradually sloping at its base into a coastal forest and mangrove formation. The island is officially preserved under the management of the Philippine National Museum. It is on this island that the famous Tabon Caves, site of the oldest human remains in the Philippines, are located.

An Invaluable Resource, Its Potential and Its Fragility

In order to get an idea of the potential medical value of Palawan's forests, a preliminary assessment was made by comparing the list of plants we collected in Palawan during the present field work against those which have been computerized in the NAPRALERT ("Natural products alert") data base at the University of Illinois at Chicago. NAPRALERT is a unique data base of the world literature on natural products, including chemical constituents, pharmacological activities, and ethnomedical (*i.e.*, folk medicine) information. The data base now contains information on more than 30,000 flowering plant species, but includes chemical or pharmacological data on only about 20 percent of the plants collected in Palawan. Another comparison was made between the Palawan list and the plants listed in Quisumbing's *Medicinal Plants of the Philippines* (1978). Again, only 20 to 30 percent of the Palawan plants collected are to be found in this book.

It is our hope and expectation that the remaining 70 to 80 percent of the plants may yield species of medicinal importance, but serious problems confront us. At the present rate of Palawan's rain forest depletion, time may be running out. While Palawan's tropical rain forests covered 1,109,918 hectares (95 percent of the island) in 1972, today there are but 741,000 forested hectares—a loss of one third in the space of only 15 years. The situation in other Philippine islands is even more serious. At least four island provinces (Cebu, Masbate, Negros, and Panay) have lost almost all their forest cover.

One way of slowing down this process in Palawan is to impose strict conservation measures. This kind of control could greatly improve our chances of discovering more medically useful plants; it would also enhance the island's potential for economic development.

I look forward to returning soon to do further field work in Palawan's magnificent rain forests. A distant voice rings in my ears: "*Balik balik Palawan*—'come back, come back to Palawan,'"—traditional words of farewell to the departing visitor. **FM**

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FIELD MUSEUM TOURS

Southwestern China Cultural Relics Study Tour

September 15 - October 6
Leader: Katherine Lee Yang

Street peddler with wares, Yunnan. Katherine Yang

Sept. 15. Chicago/Tokyo. Your adventure begins as you board Japan Airlines flight #9. Departure 12:00 noon.

Sept. 16. Tokyo/Hong Kong. Arrive Tokyo 2:45 p.m. Connect with Japan Airlines Flight #65 at 5:30 p.m. to Hong Kong. Arrive at 8:50 p.m Overnight at Shangri La Hotel.

Sept. 17. This morning we fly to Kunming. After transfer to the hotel, the remainder of the day is at leisure. This evening you are invited to a banquet hosted by the provincial government.

Sept. 18. Visit the Unnan Provincial Museum. Several professionals who are specialists in their field will give us an introduction to the study program we'll cover in the next two weeks.

Sept. 19. This morning we leave by deluxe motorcoach for a countryside tour of Dali and Lijiang. Few foreign visitors have seen this area. We will have an opportunity to observe the life style of Han, Bai, and Naxi people. We will stay in the unique architectural style of Bai houses at Erhai Guest House. It is a walled compound; three sides are built with rooms while the fourth side is used as a backdrop displaying ornamental bonsai trees or flowers.

Sept. 20. This morning a well-known archaeologist in Dail will introduce us to Dali Nanzhou culture of the eighth century. We'll visit several sites as well as take a cruise on Lake Erhai. On our return we see homes where handicrafts are made, and how marble products are cut and polished.

Sept. 21. Today enroute from Dali to Lijiang we will see the beautiful mountains of southwestern China and we'll visit the Jianchuan cave stone carvings of the Tang Dynasty. Tonight we'll stay in Lijiang No. 1 Guest House.

Sept. 22. A scholar of Naxi minority culture, Mr. Zhao Gin Xiu, will help us understand the history, the people, and their way of life. Mr. Xiu was featured in the *National Geographic* article "Mountain World." As we walk through old *Fang Chen*, meaning "Square City," our experience will be enhanced by the expertise of Mr. Zhao and Mr. Lee Zi, the director of Lijiang Museum.

Sept. 23. We leave today for Dali, and enroute we will walk through Xhou Chen, where we will visit homes to see how traditional tie-dying is done. We will examine the process of marble finishing. As we are approaching Dali, we will stop to see three Pagodas at Chongsheng Temple, which were built in the late Tang dynasty.

Sept. 24. Today we return to Kunming, with some leisure time to reflect on the memories of Yunnan's hidden treasures. Then we prepare for our departure to Chengdu, Sichuan to experience another culture of China.

Sept. 25. This morning we fly to Chengdu and transfer to Jin Jiang Hotel (West Wing). After lunch we will walk through the marketplace near the hotel to see how shopping for food is done in the most populated province in China. This evening the Sichuan Cultural Department will host us to a banquet at Lai's Restaurant, where we will enjoy the world-famous Sichuan cuisine.

Katherine Yang

Grandmother and granddaughter, Yunnan.

Sept. 26. Today we will visit the Chengdu City Museum and Sichuan Provincial Museum, and Wang Jian's Tomb. We will see the bronze artifacts recently discovered in San Xin Due.

Sept. 27. We will begin our four-day countryside motorcoach tour to Meishan, Leshan, and Zigong. Our first stop is at San Su Shi (The Three Su's home estate) at Meishan. After lunch at San Su Shi, we will walk around the estate to see the home/garden architecture of southwestern China. We will arrive in Leshan in the evening for dinner and overnight at Jia Zhou Guest House on the shore of the Mian river.

Sept. 28. After breakfast we take a boat ride across the Mian river to see the Big Buddha. We then walk on a paved path along the river to Mao Hao Cave tombs, to observe a unique way of burial during the Han Dynasty. This afternoon we depart for Zigong by motor coach. Overnight at Tan Mu Lin Guest House.

Sept. 29. This morning we will visit the Salt Museum at Shaanxi Salt Merchants Guild. The exhibits are interesting; however, the architecture of the Shaanxi Salt Merchants Guild is outstanding.

Sept. 30. We travel from ZiGong to Chengdu.

Oct. 1. A day at leisure. We can help the Chinese celebrate their Independence Day. It is the 40th anniversary of the founding of the new government.

Oct. 2. We take a scenic motorcoach trip from Chengdu to the Wolong Panda Reserve District. We will stop enroute to visit farm families and a small botanical museum hidden in the mountains.

Oct. 3. Our itinerary will be adapted to the flight schedule for the return to Hong Kong. We will schedule time for rest and prepare for our return home. There will be a farewell banquet this evening hosted by the Sichuan Province.

Oct. 4. Departure from Chengdu in the early afternoon. We will arrive in the evening and transfer to the now familiar Shangri La Hotel (Kowloon) for the night.

Oct. 5. This morning we fly to Tokyo, arriving in time to enjoy a leisurely evening. Overnight at Narita Hotel.

Oct. 6. Today we continue our journey home, leaving Tokyo on Japan Airlines flight #10 at 12:00 noon and arriving at Chicago O'Hare at 9:25 p.m.

Katherine Yang

Panda in Wo Long Panda Reserve Center.

This is an outstanding cultural study tour which we believe is an excellent itinerary, especially for those who have previously visited China. It is the first time this area has been opened to visitors. Katharine Lee Yang was accompanied by government officials as they established the itinerary, and she has given Field Museum Tours the opportunity to offer the first tour. As many of you know, Katharine is an exceptional tour leader, and we are pleased to offer this program. We do not have the price finalized as of this writing, but we invite you to call for more information. An evening program will be scheduled at the Museum to show slides and give a more complete orientation about this area of China. We invite you to join us. Please make reservations by writing or call 322-8862.

TURKEY
PAST & PRESENT

October 21 - November 4, 1989
Leader: Dr. David S. Reese

Dali city gate, Yunnan. Katherine Yang

For reservations, call or write Dorothy Roder (322-8862), Tours Manager, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Il 60605

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COVER

Traditional outrigger sailing canoe from Jaluit Atoll, Marshall Islands, being carried up the south steps of the Museum. Following its six-week journey from the Marshall Islands, the canoe will be dried out, assembled, and installed in the major new exhibit "Traveling the Pacific," opening in November. Shown escorting the canoe are (l. to r.) Patricia Guizzetti, Randale Esslinger, and Jameil Al-Oboudi, all of Design and Production. Photo by Diane Alexander White 111189.13

WHERE CREDIT IS DUE . . .

The April *Bulletin*, which featured an article on the new "Families at Work" exhibit, neglected to identify and to credit staff members whose dedication and skill were critical in developing that exhibit. Susan Curran was the exhibit developer, Sydney Hart was assistant developer, Donald Skinner was the designer, and Cameron Zebrun was the lead preparator. A large support staff also contributed, in varying degrees, to its creation.

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EVENTS

World Music Programs

Weekends in June
1:00pm and 3:00pm

Program Highlights include:

☐ *June 3 & 4*

1:00pm—Chinese Music Society of North America demonstrates Chinese percussion

3:00pm—Douglas Ewart plays Japanese bamboo flute

☐ *June 10 & 11*

1:00pm—Chicago Beau plays blues harmonica

3:00pm—Darlene Blackburn demonstrates African dance

☐ *June 17 & 18*

1:00pm—Librado Salazar plays classical guitar

3:00pm—Ari Brown plays blues saxophone

☐ *June 24 & 25*

1:00pm—Eli Hoenai plays African percussion

3:00pm—Keith Eric plays Jamaican music and tells stories

The World Music Program is supported by the Kenneth and Harle Montgomery Fund and a CityArts grant from the Chicago Office of Fine Arts, Department of Cultural Affairs.

Darlene Blackburn

Weekend Programs

EACH SATURDAY AND SUNDAY you are invited to explore the world of natural history at Field Museum. Free tours, demonstrations, and films related to ongoing exhibits at the Museum are designed for families and adults. Listed below are some of the numerous activities offered each weekend. Check the activity listing upon arrival for the complete schedule and program locations. The programs are partially supported by a grant from the Illinois Art Council.

June
10, 17 12:30pm *"Museum Safari."*
Trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon, big game from Africa and seals from the Arctic.

June
10 1:30pm *"Tibet Today"* and *"Bhutan, Land of the Thunder Dragon."*
See Lhasa and other towns now open to tourists and examine important Buddhist sites during this slide lecture and tour.

These programs are free with Museum admission and tickets are not required.

Summer Children's Workshops

EXPLORE THE EXCITING WORLD of natural history in Children's summer workshops at Field Museum. Children ages 4 to 13 enjoy workshops ranging from "Dragon Tales" for 4-year-olds to "Egyptian Magic" for 10 to 13-year-olds.

Enrollment is limited and advance registration required. See the June/July/August Adult, Children, Family Program brochure for details or call (312) 322-8854 Monday-Friday, 9:00am-4:00pm for further information.

A NIGHT OF APPRECIATION
Honoring Our 1988 Volunteers

Field Museum president Sandy Boyd congratulates Marie Louise Rosenthal on her 20 years of volunteer service. Ron Testa

by Carol Carlson,
Coordinator of Museum Volunteers

1989 marks the twenty-first anniversary for the volunteer program at the Field Museum. Beginning in 1968 with approximately thirty volunteers, there are now more than 300 who serve in a great variety of ways throughout the Museum. Many departments have volunteers, including the scientific and administrative areas as well as the public areas, such as the Education Department and Membership. Volunteers catalog, label, prepare specimens, do research, edit, type, file, prepare charts, maps, and scientific illustrations, care for plants, and translate books and articles. They also lead school groups, give programs to the public, and assist with special events.

On Wednesday April 12, Field Museum celebrated the volunteer program's twenty-first year. At the same time, the 1988 volunteers were honored with a buffet supper held in Stanley Field Hall. Brightly colored decorations and vibrant spring flowers created a festive, relaxed atmosphere where volunteers and their guests were able to socialize with staff members away from the labs, offices, and exhibit halls.

As coordinator of Museum volunteers, it was my pleasure to welcome the volunteers and to speak of my own pride in being associated with the volunteer program. Being new to the program and to the

Museum it has been my great delight to learn how the teamwork of volunteers and supervisors has contributed so much to Field Museum's being recognized as one of the great natural history museums in the world.

Robert A. Pritzker, chairman of the Board of Trustees, thanked the volunteers for their dedication and service, pointing out that the volunteers are essential to the Museum's successful operation.

During the presentation of awards, Willard L. Boyd, president of Field Museum, expressed appreciation for the volunteer's contributions last year. Mr. Boyd noted that in 1988, 348 volunteers gave a total of 44,298 hours of service to the Museum, the equivalent of 24.3 full-time paid staff members. Commenting that the volunteers' commitment is enduring, Mr. Boyd presented the twenty-year service award of appreciation to Marie Louise Rosenthal. The award was an engraved crystal box from Tiffany's, endowed by William L. Searle, a trustee of the Museum. Mrs. Rosenthal joined four other volunteers who had received the Searle award at last year's twentieth anniversary volunteer recognition party. Mr. Boyd urged the other volunteers to stay for twenty years so that they, too, could receive this special honor. In the next portion of the program Mr. Boyd gave special recognition to ten volunteers. These were the five weekday volunteers with the greatest number of hours of service in 1988, and the five weekend volunteers with the greatest number of hours of service in 1988.

Volunteers with 20 or More Years of Service

Recipient of Searle Award in 1989: Marie Louise Rosenthal

Since August 1969 Marie Louise has contributed her time and talents to Field Museum. Over the past twenty years she has been involved with the Library, under the supervision of William Fawcett and Ken Grabowski. Marie Louise's volunteer service has related primarily to the conservation of valuable library materials. Her duties have included repair work and oiling of bindings, and she is currently making boxes for works that are too fragile to be rebound. She is the fifth volunteer to achieve the 20-year distinction, joining Stan Dvorak, Ellen Hyndman, Dorothy Karall, and Anne Ross, honored last year as the charter members of the volunteers' "Twenty-Year Club." In addition to her excellent work in the Library, Marie Louise is a member of Field Museum's Women's Board.

Weekday Volunteers with the Greatest Number of Hours in 1988

Edward Yastrow for Anthropology Department:
Glen Cole, supervisor; 664 hours in 1988.

William Roder for Tours:
Dorothy Roder, supervisor; 660 hours in 1988

Llois Stein for Anthropology Department:
Phillip Lewis, supervisor; 621 hours in 1988

Sophie Ann Brunner for Amphibians and Reptiles Division:
Hymen Marx and Molly Ozaki, supervisors; 609 hours in 1988

Ingrid Fauci for Amphibians and Reptiles Division:
Molly Ozaki, supervisor; 598 hours in 1988.

Weekend Volunteers with the Greatest Number of Hours in 1988

Gary Ossewaarde for Education Department:
Philip Courington, supervisor; 565 hours in 1988.

Mary Nelson for Education Department:
Ingrid Melief, Mary Ann Bloom, supervisors; Anthropology Department: Glen Cole, supervisor; 537 hours in 1988.

Jacqueline Arnold for Education Department:
Mary Ann Bloom, supervisor; 283 hours in 1988.

Debra Jean Frels for Education Department:
Nancy Evans, Ingrid Melief, supervisors; 249 hours in 1988.

Dennis Kinzig for Education Department:
Peter Laraba, supervisor; 225 hours in 1988.

Volunteers with 500 or More Hours in 1988

Margaret Martling for Botany:
William Burger, supervisor.

Worthington Smith for Library:
Benjamin Williams, supervisor.

400 or More Hours

Colleen Casey for Botany:
Robin Foster, supervisor.

Lillian Kreitman for Membership:
Marilyn Cahill, supervisor.

Sarah Rosenbloom for Education:
Mary Ann Bloom, supervisor.

Bruce Saipe for Public Relations:
Sherry DeVries & Lisa Elkuss, supervisors.

Randy Upton for Botany:
Steve Dercole, supervisor.

300 or More Hours

Paul Baker for Birds:
Dave Willard, supervisor.

Dennis Bara for Membership:
Marilyn Cahill, supervisor.

Sol Century for Anthropology:
Bennet Bronson, supervisor.

Peter Gayford for Anthropology:
Catherine Gross, supervisor.

Thomas Gnoske for Mammals:
Julian Kerbis, supervisor.

Mary Lou Grein for Botany:
John Engel, supervisor.

Rosemary Kalin for Education:
Mary Ann Bloom and Ingrid Melief, supervisors.

Robert Masek for Geology:
William Simpson, supervisor.

John Phelps, Jr. for Mammals:
Greg Guliuzza, supervisor.

James Reed for Library:
Ken Grabowski, supervisor.

Frances Stromquist for Archives: Mary Ann Johnson, supervisor.

50 or More Hours

Julia Abarbanell
Neal Abarbanell
Lisa Adler
Paul Adler
E. Erelah Ajao-Spears
Patinya Ambuel
Dolores Arbanas
Tony Armour
Jacqueline Arnold
Ian Ausubel
Paul Baker
Barbara Ballard
Dennis Bara
Lucia Barba
Dr. George Barnett
Gwen Barnett
Dodie Baumgarten
Barbara Beardsley
Virginia Beatty
Jeanne Bedrosian
Susan Bee
Timothy Benally
Susan Bennett
Robert Berns
Ruth Berns
Elaine Bernstein
Freida Bernstein
Fran Braverman
Carol Briscoe
Carolyn Brna
Irene Broede
Garland Brown
Robert Brunner
Sophie Ann Brunner
Jim Burd
Joseph Cablk
Kitty Carson
Robert Cary
Colleen Casey
Sol Century
Cathy Cline
Peter Coey
Byron Collins
James Coplan
John Cox
Leslie Cox
Virginia Cox
Connie Crane
Eleanor DeKoven
Jeannette DeLaney
Violet Diacou
Phyllis Dix
Patricia Dodson
John Dunn
Stanley Dvorak
M. Alison Ebert
Linda Egebrecht
Bonnie Engel
Eric Espe
Elizabeth Farwell
Ingrid Fauci
Josephine Faulk
Mitzi Fine
Barbara Fisher
Joseph Fisher
Amy Franke
Toby Frankel
Arden Frederick
Debra Jean Frels
Carlene Friedman
Kirk Frye
Barbara Gardner
Ronald Garner
Peter Gayford
Patricia Georgouses
Ann Gerber
Phyllis Ginardi
Delores Glasbrenner
Vonda Gluck
Thomas Gnoske
Halina Goldsmith
Karin Goldstein
Evelyn Gottlieb
Robert Gowland
Deborah Green
Loretta Green
Frank Greene, Jr.*
Henry Greenwald
Mary Lou Grein
Ann Grimes
Dennis Hall
Michael Hall
Afshan Hamid
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Craig Kiefer
Dennis Kinzig
Alida Klaud
Susan Knoll
Lillian Kreitman
Carol Landow
Michelle Lazar
Sandra Lee
Frank Leslie
Jane Levin
Joseph Levin
Ruth Lew
Valerie Lewis
Catherine Lindroth
Mary Jo Lucas-Healy
Janet Madenberg
Gabby Margo
Maryann Marsicek
Phyllis Marta
Margaret Martling
Robert Masek
Clifford Massoth
Marie Dulce Matanguihan
Britta Mather
Selwyn Mather
Melba Mayo
Samuel Mayo
Tom McNichols
Withrow Meeker
Beverly Meyer
Barbara Milott
Lawrence Misialek
Carolyn Moore
Susan Moy
Stella Muir
Gail Munden
George Murray
Carolyn Mylander
Patricia Naughton
John Nelson
Mary Nelson
Louise Neuert
Donald Newton
Virginia Newton
Doris Nitecki
John Notz
Dennis O'Donnell
Dorothy Oliver
Joan Opila
Gary Ossewaarde
China Oughton
Marcella Owens
Anita Padnos
Martha Pedroza
John Phelps, Jr.
Dorothea Phipps-Cruz
Julie Pitzen
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Llois Stein
Frances Stromquist
Ruby Suzuki
Beatrice Swartchild
Ann Ternenyi
Jane Thain
Karen Thomas
Kathleen North Tomczyk
Gregory Trush
Ginny Turner-Erfort
Randy Upton
Lillian Vanek
Jeffrey Vaughn
Teri Vlasak
David Walker
Maxine Walker
Dorothea Wechselberger
Corinne Weigand
Reeva Wolfson
Zinette Yacker
Edward Yastrow
Laura Zaidenberg

**Deceased*

Among the Maya
Photographs by Justin Kerr

on view through July 30

Mayan flint carving, Late Classical Period, A.D. 600-800 Photo by Justin Kerr

"Among the Maya: Photographs by Justin Kerr" documents the rich cultural legacy of the Maya people and includes more than 60 color photographs depicting 3,000 years of Maya culture. Justin Kerr is widely acclaimed as the greatest living photographer of Maya art.

"Among the Maya" covers several themes, including the faces of ancient and contemporary Maya portraiture; surviving architectural monuments; magnificent artifacts created from a variety of materials; and the life of present-day Maya Indians. The world of the Maya, both past and present, is eloquently represented through this unusual collection of photographs.

The works on view in "Among the Maya" represent the fruit of 20 years of study and travel in the villages of Mexico, Guatemala, and Honduras, where Kerr has photographed ancient Maya temples and palaces, together with the villages of contemporary Maya Indians. He has produced outstanding photographs of important Maya artifact collections held by museums world-wide. Kerr's photos are featured in the book *The Blood of Kings: Dynasty and Ritual in Maya Art,* by Linda Schele and Mary Miller.

"Among the Maya" can be seen in the exhibition gallery of the Webber Resource Center For Native Cultures of the Americas from noon to 5pm on weekdays and 10am to 5pm on weekends. The exhibit is free with regular Museum admission.

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Coyote
Serigraph, 22" × 30"

COYOTE: A MYTH IN THE MAKING

Contemporary Native American art

April 8 to July 9

"Coyote: A Myth in the Moking" presents the paintings and sketches of contemparary Native American artist Harry Fonseca. The exhibit focuses on Fonseca's vision of Coyote, a magical being prominent in the traditional literature and religious beliefs of many Native American cultures. The exhibit traces Coyote's history as he emerges from Fonseca's Maidu heritage and leaves the reservation to participate in many facets of American life. Through Coyote, Fonseca provides a lively commentary on can-

---

A Gift from California
Serigraph, 22" × 30"
A Gift from California presents Fonseca's assertion that the Indian culture of California was alive and very different from that of the Southwest. The serigraph illustrates a women's dance, which honors both the acorn and women as givers of life; the four dancers carry burden baskets filled with acorns, a traditional staple of life for the Maidu and a symbolic representation of Maidu culture. The traditional Maidu basket designs are, left to right, winged lightning, angleworm, quail plume, and ants on a log.

QUAIL
OPEN
505-26

temporary urban life and timeless human nature. As an artist, Fonseca has developed his own style that has been referred to as "primitive," "naive," and "California funk." While his bold and colorful work reflects qualities of each of these styles, it goes beyond to create his own personal statement as a visual artist.

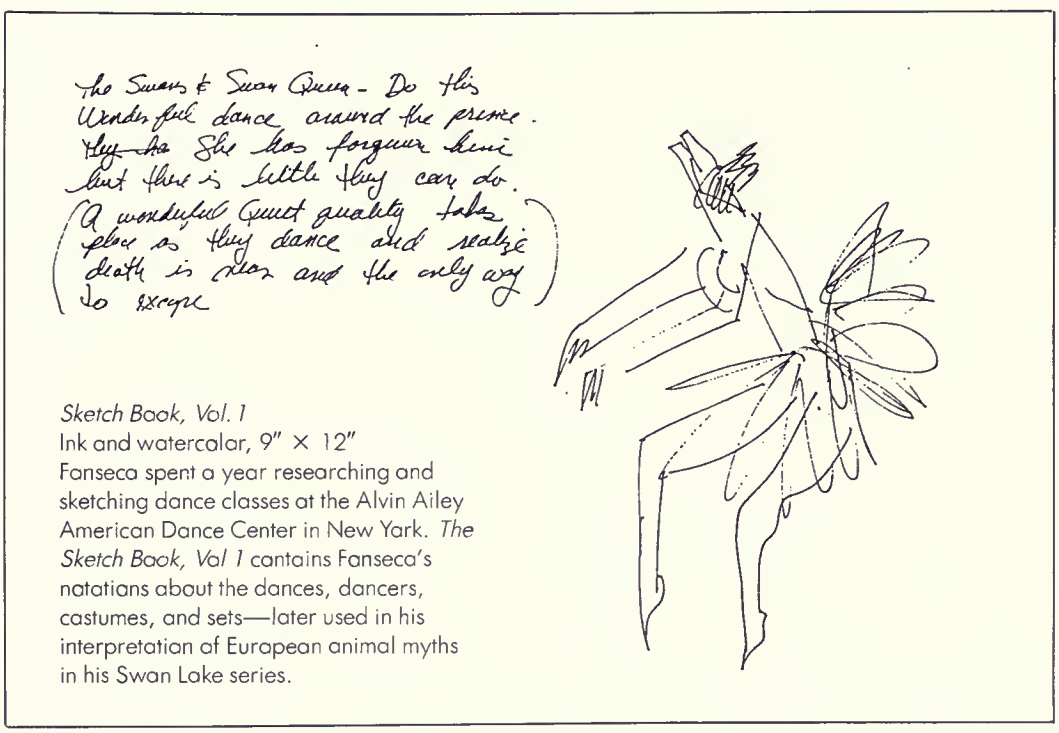
Among many Native American peoples, the coyote is a trickster figure. Among the Maidu of northern California, however, Coyote is more than just a spoiler—he also provides a guide through life, demonstrating what behavior is unacceptable and dangerous, providing opportunities for others to learn from his mistakes. According to Maidu oral tradition, Coyote is also responsible for the existence of work, suffering, and death. He is, on the other hand, a buffoon, the trickster who is only tricking himself, who comes out of his adventures in a sorry plight.

Harry Fonseca was born in Sacramento, California, in 1946; he is of Maidu, Portuguese, and Hawaiian descent, and he grew up in Sacramento acutely aware of his mixed heritage. However, he was greatly influenced by his uncle Henry Azbill, a Konkow Maidu elder, who encouraged him to attend the Maidu dances at Grindstone, near Chico. Azbill was a great promoter and preserver of the Maidu culture, which had undergone tremendous turmoil after the tribe was decimated following the influx of gold seekers and settlers to their land in California's northern Sierra.

Fonseca is largely self-taught: "I've been drawing this way since I was twelve years old," he said in a recent interview. His earliest works relate directly to his Maidu heritage. As part of an assignment for a class in American Indian art at California State University, Sacramento, Fonseca tape-recorded his uncle telling the Maidu creation myth. After recording the story, Fonseca realized that it was more than a creation myth; it was the tribal history. In 1976, Fonseca applied for and received a Special Projects Grant from the California Arts Council to aid in the making of the *Creation Story.* This marked the beginning of the three-year project that became the visual record of an oral history.

Fonseca's early works, created in the late 1960s through the 1970s, have been referred to as his "traditional" paintings—traditional because Fonseca was illustrating the Maidu culture, the dances, the regalia, and the basket designs, "the beginnings," as he said, "of the California people."

⇦ *Coyote in front of Studio*
Acrylic, 30" × 24"
Fonseca uses Coyote to poke fun at the familiar stereotype of the American Indian. The urbanized Coyote, in black leather jacket, Levi's, and high-top tennis shoes, wears the Hollywood-approved version of the most recognizable item of Indian dress, a full Plains-style feather headdress. Coyote also carries a large beaded leather bag and holds three cigars as he stands on a wooden box. Through Coyote's regalia, which is not worn in the artist's own Maidu culture, Fonseca satirizes the stereotype of the "real" Indian.



Sketch Book, Vol. 1
Ink and watercolor, 9" × 12"
Fonseca spent a year researching and sketching dance classes at the Alvin Ailey American Dance Center in New York. *The Sketch Book, Vol 1* contains Fonseca's notations about the dances, dancers, costumes, and sets—later used in his interpretation of European animal myths in his Swan Lake series.

Indian Trade Silver

Ornaments of sheet silver, like this cross and gorget, were made specifically for use in the North American fur trade by silversmiths in Canada, England, and the United States. Silver ornaments were first introduced to North American Indians in the form of diplomatic gifts and later became a significant item in commercial trade. The earliest ornaments were medals which were given to Indian leaders as a badge of honor and to secure friendly relations with the various tribes. Indian allies became extremely important, particularly to the French and British in the Great Lakes area, and the amount and variety of silver ornaments presented during alliance ceremonies proliferated. In addition to diplomatic alliances, Europeans also desired the impressive profits that could be derived from trade for furs and, as Indians wanted silver for their furs and services, traders became increasingly aware of the necessity of including such items as brooches, earrings, armbands, crosses, and gorgets in their trading inventories. With this accelerated demand, by the mid-18th century silver ornaments were being produced specifically for the Indian trade. Many ornaments were marked with the name of the silversmith who made them and thus are considered to be an excellent criterion for dating archaeological sites in the western Great Lakes, as well as elsewhere in eastern North America, between *ca.* 1760 and 1820.

Silver cross and gorget from Indian grave in Will County, Illinois. The cross bears the mark of Robert Cruikshank, a Montreal silversmith. Cat. 207710 (cross) and 207713.
Photo by Ron Testa, neg. 11140

"I did it! I did it! All by myself."

The Hall Interpretive Program

by Philip Courington
Coordinator, Hall Interpretive Program

photos by Robert A. Feldman

Bright yellow banners with a dark blue question mark tell you that a Field Museum hall interpreter is busy at work. These cheerful, friendly, well-informed staff members have carts loaded with intriguing things. He or she may be giving a four-year-old a loop of string, then showing the child how to make an Eskimo string figure.

Another interpreter may be introducing a family to a fascinating activity called "Horns and Antlers." The younger child tries on a pair of antlers for that souvenir snapshot while the older child voices amazement that horns are made of "fingernail stuff." The delighted parents confess that in twenty years of school they never learned that deer grow new antlers each year. Every Thursday through Sunday and on most holidays, interpreters hear countless adults and kids saying things like "Wow! No kidding!" and "Thanks, I never knew that."

In *Centennial Directions* (Field Museum *Bulletin*, October 1986), as the Museum looked toward the needs of its second century, it committed itself to providing even more varied experiences for visitors —a commitment to create a museum that would be human, approachable, and *fun*. In 1986 the Joyce Foundation and the Lloyd A. Fry Foundation provided funds to support this innovative program for three years.

Museum staff then developed 45 activities to

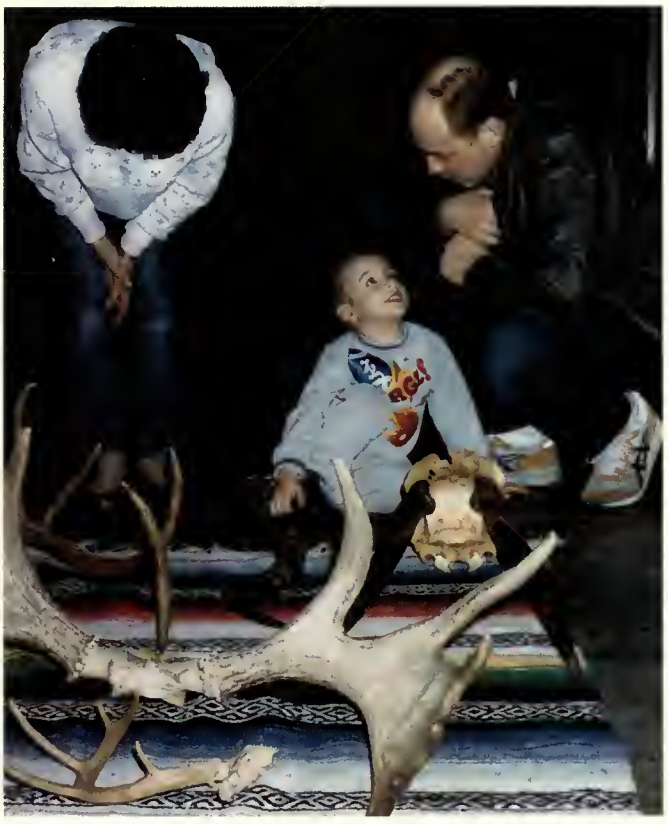
"This is 6 bushels of grass."

communicate in diverse ways concepts related to human and natural history. Each activity would be a portable program that could be taken to any of the Museum's public areas. The object-based format meant lots of trial and error for the staff, with cooperative visitors testing many kinds of activities. Would families be agreeable to getting down on the floor to grind corn in the style of a Hopi Indian? Would this experience enhance their understanding and appreciation of Hopi life? Would they enjoy themselves while getting corn dust on their clothes?

For each activity, a core of background information is developed, a process in which the Museum's curator scientists provide valuable assistance. Various techniques are used for interpreting information in ways that will captivate the visitor. Objects used in these activities—as diverse as owl pellets, papyrus pith, and thumb pianos—are obtained in various ways, and from various sources, but all are meant to be handled, manipulated, investigated; the musical instruments are meant to be played.

"Making paper from papyrus is fun."

"No we didn't put the fossils in the marble floor."



"Do you think it's real?"

What exactly is a "hall activity"? There are many formats: "Fossils in the Floor" helps visitors recognize animal fossils preserved in the Museum's limestone floors. Using huge magnifying glasses in mounts that look like small footstools, the fossils come alive before your eyes. An interpreter displays other fossil specimens on his cart and explains how the ancient animals and plants turned to stone. Activities in the Museum's new Egypt exhibit, next to a recreated Nile River marsh, involve visitors in making paper from papyrus. A board holding magnetized metal hieroglyphs gives kids as well as grownups the fun experience of writing their own names in the same symbols used by ancient Egyptians. The interpreter tells what each hieroglyph symbolizes. "Adzes and Awls" is an activity emphasizing how and why Native American tools were used. After a demonstration by the interpreter, visitors are encouraged to try the tools and offer their own ideas of what they were for. There are many more, varied activities taking place throughout the Museum, each offering the visitor his own approach to explore and discover at Field Museum.

Who are the Hall interpreters? These special people must be enthusiastic improvisors, people who enjoy people, and who are able to skillfully handle every kind of situation and visitor need that might arise. They must become conversant with four complex disciplines. They have to be comfortable with a position which is only part time, but demanding, and have a genuine interest in what Field Museum is all about. Many have college degrees in anthropology, biology, or geology and some have experience in teaching, theater, or occupational therapy. Some are in their early twenties, others are seniors. They include an art teacher, an aspiring actress, a writer, a bank employee, and a kindergarten teacher from Guatemala working toward her Illinois certificate. Former hall interpreters have gone on to graduate studies, full-time employment at the Museum, the Peace Corps, even a TV comedy show.

Their diversity mirrors that of the Museum's visitors. Because of these special people who "speak their own language," visitors are finding that Field Museum is indeed a warmer, friendlier place. Next time you are in the Museum, be sure to look for the cheerful yellow banners with the big question mark. Join the fun—explore, discover with us. We'll be looking for you! **FM**

"This isn't as easy to do as it looks."

HENRY HERING and the Case of the Missing Maidens

by David M. Walsten

Twenty-eight beautiful young women were scheduled to travel from New York to Chicago, sometime during World War I, their destination being the Field Museum's new building in Grant Park. Some of the ladies were lucky enough to make the trip, some never did, and some didn't arrive until several years later.

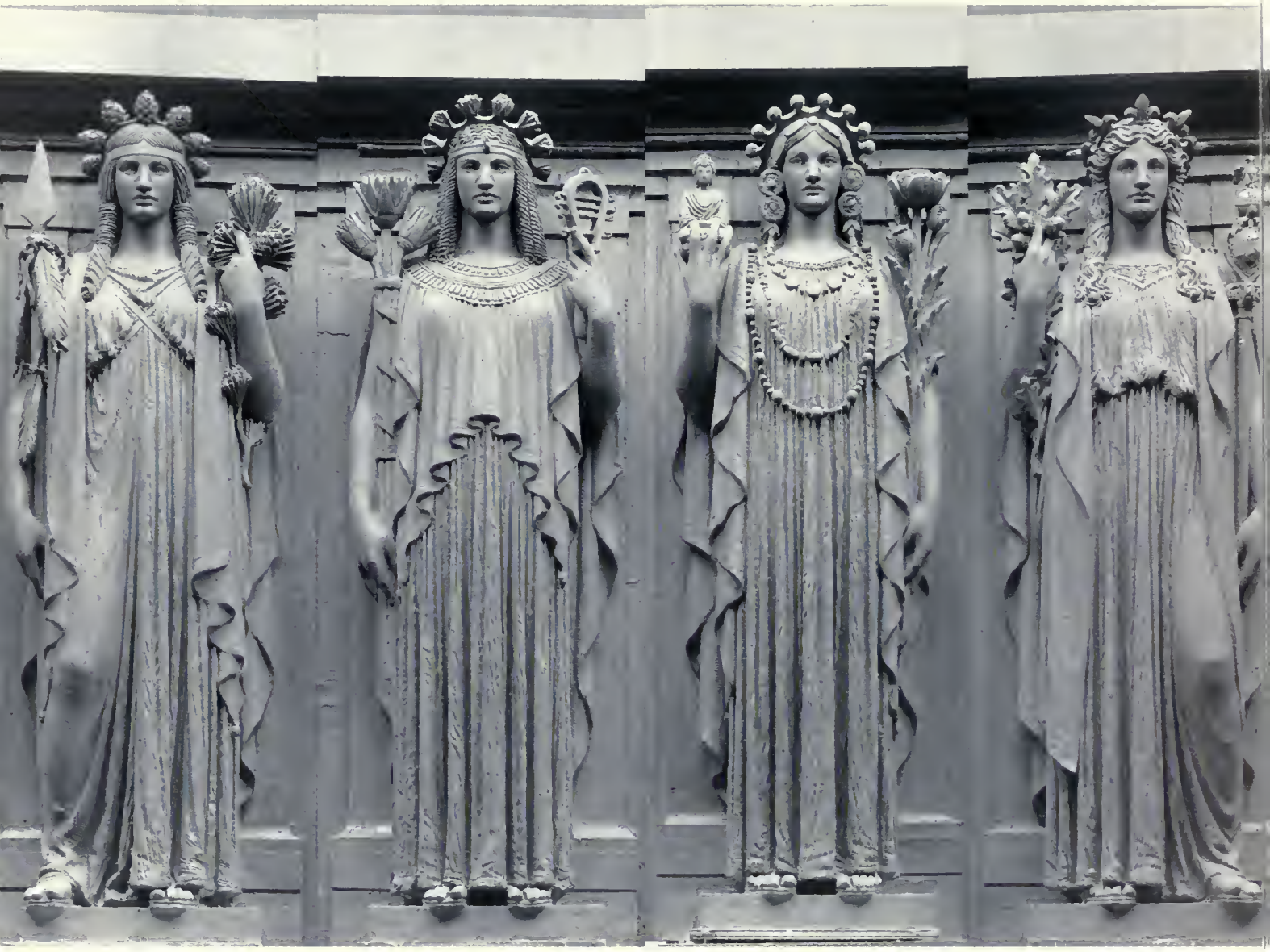
It's worth noting that despite their beguiling features, these women, without exception, had hearts of stone—as well as arms and legs and everything else of stone.* They were the creations, or intended creations of New York sculptor Henry Hering (1874-1949), who was commissioned in 1916 to do all the statuary, as well as bas relief figures, commemorative plaques, and other decorative items for the building.

The statues which made the trip to Chicago more or less according to plan included the alabaster-white figures ("Science," "Research," "Record," and "The Dissemination of Knowledge") now to be seen prevailing on high in Stanley Field Hall and eight caryatids (female statue-pillars) on the small porches flanking the north and south entrances. Those statues which never materialized pose a number of intriguing questions, which might never be answered. Why, for example, do we see four of those "missing" figures today in duplicate sets, above the north and south entrances to the Museum of Science and Industry? That institution took up residence in the Field Museum's original quart-

*A little artistic license here—four of the figures were of plaster, not stone.

Clay model of "Zoology," one of four panels representing the Museum's curatorial departments. These panels are to be seen today as 13-foot marble figures on the building's exterior. This model was photographed in the Manhattan studio of the sculptor, Henry Hering, in 1916.

"Dissemination of Knowledge," by Hering, to be seen in the northeast corner of Stanley Field Hall. This photo was made in March of this year, just after the entire hall was repainted.
Diane Alexander White 85335



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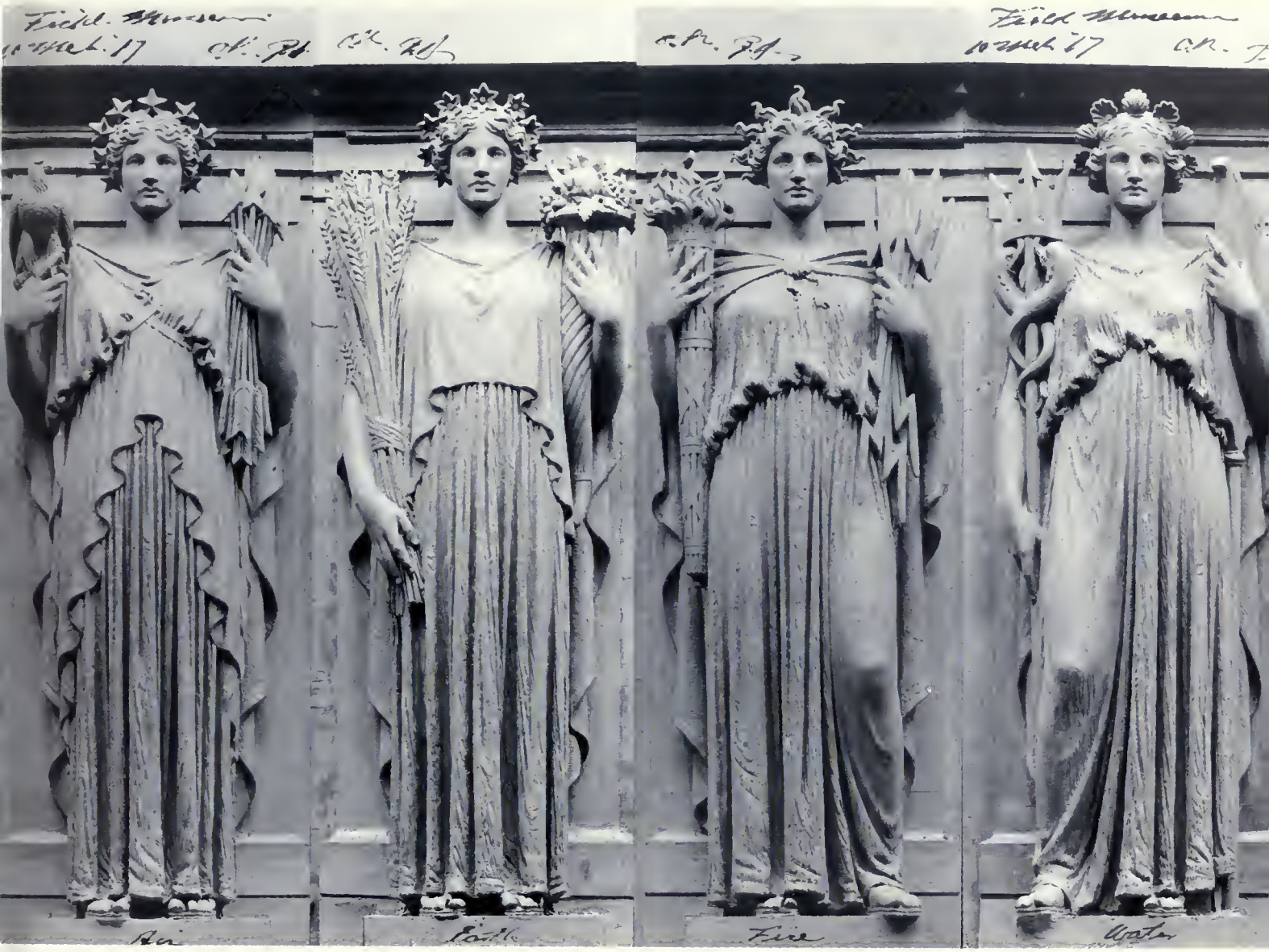
Clay models of eight figures commissioned for the Field Museum but never realized in marble. The first four (from left) represent north, south, east, and west. These eventually appeared, in limestone, above the north and south entrances of Chicago's Museum of Science and

ers, opening to the public there in 1933 some 13 years after Field Museum's departure and following radical reconstruction.† These four statues were added to the building some time after 1926, the year the newer museum received its charter, though we know from dated photos that clay models of the figures were done as early as 1916. These four, representing the four cardinal directions, together with models of figures representing the four elements—earth, air, fire, and water—were photographed in Hering's Manhattan studio in November 1916, positioned on a model of the Museum's portico (north or south). This total of eight figures standing in a row on separate pedestals was to appear over both the north and south entrances.

More than seventy years removed, we cannot be certain why these eight were abandoned, though the costly marble pieces may have been stricken for budget reasons (those were difficult years for the Museum). The eight caryatids, also of marble, were far less expendable since, as porch columns, they were integral

†The original building, the so-called Palace of Fine Arts, had been constructed in 1893 for the Columbian Exposition, and was not designed to survive for more than the fair's duration. By the time the Field Museum completely vacated the structure a quarter-century later, the "palace" was a shambles.



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Industry. The remaining four—air, earth, fire, and water—apparently never got beyond the model stage, though the models were approved by Field Museum architect Peirce Anderson early in 1917. His "O.K." is to be seen at the top of each of these four photos.

to the building's structure, not just embellishments. The four statues in Stanley Field Hall were unlikely candidates for elimination since, as relatively inexpensive plaster figures, not a great deal would have been gained by scrapping them.

A Prolific Sculptor

The story of Henry Hering's life is one of awesome productivity. His Chicago commissions alone, done from about 1917 to 1930, involved more statuary than many sculptors achieve in a lifetime. Today all of this may be seen in the city's busiest areas: in Union Station (two statues), on the Civic Opera House (four bas relief figures), on the south pylons of the Michigan Avenue Bridge (two bas relief groups), plus the many figures for the two museums. He also did a stylized eagle medallion on the façade of the Federal Reserve Bank Building.

The most imposing piece by Hering in the Chicago area is a 25-foot bronze representation of Père Marquette in Gary's Marquette Park. The seated bronze figure of Lincoln in Grant Park was largely the work of Hering, though officially credited to Augustus Saint-Gaudens (1848-1907), Hering's mentor and the most distinguished American sculptor of his time.

Above: Model of main entrance (north or south) of Field Museum in Hering's studio, with models of eight projected figures in place. Note Peirce Anderson's Nov. 6, 1916 "O.K." The circular shield with lion's head, at center, was completed in marble as planned. Twelve plaster duplicates of this shield are also to be seen today on the east and west walls of Stanley Field Hall.

Left: Clay model of lion's head shield.

South portico of the Museum of Science and Industry, showing the figures symbolic of the four cardinal directions, flanked by identical winged figures. The winged figures were probably done by Hering as well (see also top photo, p. 25). All are in limestone.

Hering also did a memorial plaque for Chicago's John Crerar Library and a number of privately commissioned busts or portrait reliefs of well known Chicagoans, notably of architects Ernest B. Graham and Peirce Anderson (both were partners in the firm which designed Field Museum), and of former Field Museum director Frederick J. Skiff. When the nation was still on the gold standard, Hering's work could be seen on the $10 and $20 gold pieces minted between 1907 and 1933. As in the case of the Lincoln statue, Saint-Gaudens is credited with designing these coins, though it was Hering who did much of the fine modelling. The $20 gold piece, or "double eagle," is commonly regarded as the most beautiful U.S. coin ever minted.

Outside of Chicago, Hering's most notable work includes statues of Abraham Lincoln and Woodrow Wilson in Indianapolis; a Civil War memorial at Yale University; heroic bridge pylon figures, statuary for the Federal Reserve Bank, and pediment figures for Severance Hall, all in Cleveland. A complete catalog of Hering's statues, busts, portrait reliefs, medals, and other types could be one of the most extensive in the history of sculpture. But Henry Hering's name is not to be found in standard texts on American art; even sculpture buffs in Chicago, where he is best represented, are likely to draw a blank if his name is mentioned. Perhaps that is the fate common to those whose work is in a traditional vein.

Among Hering's champions, however, was Metropolitan Museum of Art curator Charles Over Cornelius, who wrote at length about Hering's Field Museum work in the November 1918 *Architectural Record*:

> The whole group [of figures] is characterized by the eminent dignity and restraint which run throughout all of

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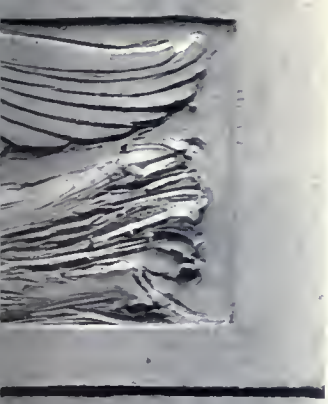
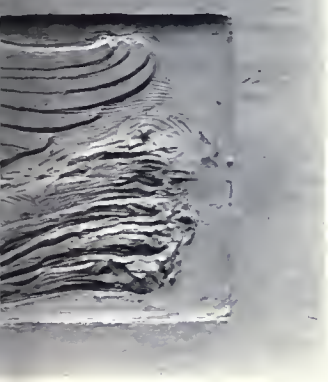


Left: Early clay maquettes of panels representing the Museum's four departments.



Below: Progressive stages in the creation of (from left) "Science," "Research," and "Record." All are clay maquettes.

Mr. Hering's work—a dignity unfettered by academic formulae nor yet disturbed by a factitious realism. In the sane mind of the trained sculptor these two extremes of classicism and realism have been fused into an expressive whole under the spell of his own individual approach. In this particular problem there was opportunity for a variety of treatment into which has been breathed much of the spirit of ancient Greece.

There are many who will concur in the opinion that the art of sculpture has reached and always will reach the broadest expression of its purpose when conceived and carried out with relation to architecture which it may be designed to enhance. Of the greatest sculpture which has come down to us from the past, by far the larger part is permeated by qualities suggested, if not imposed, by the architectural design of which it formed an essential part.

Hering's career began as a silversmith's apprentice in New York. At the age of 14 he was enrolled in the Cooper Union School of Art, at 17 studied under Philip Martiny (who did the exterior figures for the Columbian Exposition's Palace of Fine Arts), and from 1894 to 1898 he worked at New York's Art Students'

Opening day of Field Museum, June 2, 1894, at the north entrance. Note similarity between caryatid figures on small porch and the caryatid figure of Henry Hering on p. 26 (right figure of pair). Note as well similarity of winged figure on pediment (partly visible above large statue) to winged figures on p. 25. Statuary on the Palace of Fine Arts (shortly to become the Field Museum) was done by Philip Martiny, Hering's teacher. Hering's caryatids, of which there are 8 on Field Museum's exterior and 24 on the Museum of Science and Industry, appear to be very similar to, if not copies of Martiny's. The winged figures, of which there are 12 on the Museum of Science and Industry, seem equally faithful to Martiny's.

League. In 1900 and 1901 Hering was a student at L'École des Beaux Arts in Paris. While there he came under the tutelage of Saint-Gaudens, remaining his assistant until Saint-Gaudens' death in 1907. Hering opened his own studio in New York in 1910.

Selecting the Museum's Sculptor

Sculptors were enquiring about doing the statuary for the new building as early as 1911, long before construction began. Among the first to offer his talents was Charles J. Mulligan, an instructor at the Art Institute of Chicago who had already done statues of Presidents McKinley (1905) and Lincoln (1911) for Chicago park memorials. Another applicant was the accomplished Philip Martiny, Hering's former teacher.

In August 1914 it was decided that the caryatids were to be done by A. A. Weinman, designer of a U.S. dime and half-dollar, and the interior work by Mary Evelyn Longman, who had been an assistant of the renowned Daniel Chester French. French, who had done the Marshall Field memorial in Chicago's Graceland Cemetery, was chosen to do a seated figure of Field to be placed just in front of the Museum's north entrance.

Right: Winged figures on the Museum of Science and Industry, probably the work of Henry Hering.

The following year, however, plans for the Field statue were scuttled, apparently because of contract difficulties concerning the metalwork; but ultimately, perhaps, because costs of the project exceeded expectations—French's fee alone was $27,000.

In the fall of 1915 there was yet another change of plans; Hering—perhaps the least distinguished of the candidates—was named to do all of the work for the building, inside and out. A contract for $22,000 was signed the following April. By January 1917 Hering was far enough along to send photos of his work to Peirce Anderson. Anderson replied: "Your caryatids are perfectly bully, and I congratulate you very heartily on the outcome of these, the first work finished by you in final form. The handling of the drapery and other details is certainly a joy to the eye. . . ."

Six weeks later Anderson took the train to New York to see how the work was progressing. He wrote Field Museum president Stanley Field:

Below: North entrance of the Field Museum near the end of its days in Jackson Park, probably around the time of World War I. Gone is all the statuary shown on page 24, initially planned to last only for the duration of the Columbian Exposition in 1893. It is obvious that the entire building surface is in a serious state of disrepair. The building underwent radical reconstruction before reopening as the Museum of Science and Industry in 1933.

Left: Caryatids, old and new. Left is an original Greek caryatid, now in the British Museum, and taken from the Erectheum, an Ionic temple on the Athenian Acropolis, completed in 410 B.C. Right is Henry Hering's version, to be seen in marble on the outside of Field Museum and in limestone on the outside of the Museum of Science and Industry. Both museums have two versions—one with the left knee forward and with brooch, the other with right knee forward and without brooch.

Right: Final and earlier clay models of Hering's "Dissemination of Knowledge."

Henry Hering's work may be seen today in many parts of the United States. The two figures at upper left ("Security" and "Integrity") are on the Federal Reserve Bank Building of Cleveland. Lower left: Hering's monumental "Regeneration," on the southwest pylon of the Michigan Avenue bridge, completed in 1923. This epic piece memorialized the Chicago fire of 1871 and honored those who "caused a new and greater city to rise, imbued with that indomitable spirit and energy by which they have ever been guided." Above: 12-foot gilded plaster figures, "Night" and "Day," in Chicago's Union Station.

Clay model of panel "Anthropology," on building's exterior.

"I [looked at] the first four figures* of the main pediment in Hering's studio in order that they might be gotten in work without delay. . . . It seems to me that these models are one [sic] of the finest pieces of decorative sculpture that have been produced in modern times."

Field pencilled on the back of Anderson's letter: "The 1st 4 figures of the main pediment. . . meet with my entire approval. I am. . . delighted with them."

Things moved along smoothly until April 24, when Stanley Field in a state of agitation wired Ernest R. Graham, the architectural firm's senior partner then visiting New York: "Henry Herring [sic] is talking of joining the Officers Reserve Corps. . . and wants your consent general contractors consent and our consent. Please see him to-day sure and discuss this matter." He also wrote Graham that Hering was "evidently going . . . to take three months of intensive training, and I do not see how he can possibly do it without neglecting the museum work."

Graham apparently talked Hering out of his plan —for the time being at least. But the following year Hering yielded to his patriotic conscience and joined the 40th Engineers Corps.

In the final letter of Hering's to be found in the Field Museum archives, dated August 6, 1917, he wrote Field: "I am sending you. . . fourteen photographs. . . . Twelve of these represent the sculpture of Field Museum completed up to date. There still remain two more panels Anthropology and Geology and four interior figures. . . and will send you photographs of them when completed."

Stanley Field replied, "Those [photographs] of the museum models are superb. I cannot begin to tell you how fine I think the work is. . . . I have taken up with the architects the matter of the stone cutting. There will be a meeting here next week. . . and it is hoped that the work can proceed immediately afterward." With Field's letter, the Museum's file on Henry Hering comes to a close.

Hering went into semiretirement in 1940, exchanging the sculptor's chisels for a set of golf clubs. Golf, in fact, became the ruling passion of his later years. He designed the Scarsdale (N.Y.) Golf Club championship medal and even tinkered with a new type of club which, he argued, conformed better to aerodynamic principles.

It was Henry Hering's love of the sport that probably saved his life one July day in 1945 and, perhaps for the first time, put his name on the front page of the *New York Times*, rescuing him briefly from the pall of obscurity. Following an afternoon on the golf course, Hering returned to Manhattan to find the smoldering wreckage of a U.S. Army bomber in his penthouse studio on west 33rd Street. Lost in fog, the plane had crashed into the Empire State Building, parts of the bomber plummeting through Hering's skylight. According to a contemporary account, Hering's first concern was not for the works of art that cluttered his studio but for the safety of his experimental golf clubs. **FM**

* These were among the eight that were never delivered.

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FIELD MUSEUM TOURS

TURKEY
Past and Present

OCTOBER, 1989

Sat 21 Chicago/Zurich. Our adventure begins as we board our overnight Swissair flight to Zurich.

Sun 22 Zurich/Ankara. We arrive in Turkey's capital city of Ankara in the early afternoon and transfer to our hotel, the deluxe **Etap Altinel,** to rest and refresh ourselves before our evening Welcome Dinner. Ankara, set in Turkey's strategic heartland, is a modern city with a long and fascinating heritage that stretches back nearly 10,000 years. Once a Hittite settlement in the second millennium B.C., five centuries later it became the capital of the Galatian nation. D

Mon 23 Ankara/Cappadocia. We set out this morning on an exploratory tour of the city of Ankara: the Citadel, or Kale, the original fortress of the old city, the Hittite Museum with exhibits dating back to cave paintings and stone-age relics, as well as an extensive collection of rare Hittite artifacts, Haci Bayram Mosque, one of Ankara's oldest, and Anit Kabir, Ataturk's Mausoleum, a giant stone rectangle set on a hill in the midst of the city. Following lunch at the Milka Restaurant, we continue to Cappadocia and visit the Byzantine refuge city of Derinkuyu, a vast and amazing underground complex of entire communities inter-connected by tunnels. Dinner is taken enroute in Alsaray, and we arrive late this evening at our hotel in Cappadocia, the elegant **Boydas.** B/L/D

Tue 24 Cappadocia. Thanks to a series of violent volcanic eruptions three million years ago, Cappadocia—in the very center of Anatolia—is one of those rare regions in the world where the works of man hollowing out rocks to build dwellings, chapels and monasteries blend in perfect harmony with Nature's own surrealistic landscapes. Here, against the majestic backdrop of 13,000-foot Mount Erciyes, the earth's terrain takes on an almost moonlike appearance, with gouged valleys, rock cones, capped pinnacles and fretted ravines in colors ranging from warm reds and golds to cool greens and grays. Here, the troglodyte (rock) dwellings date as far back as 400 B.C., and the multi-level underground cities reach well below the surface of the earth. In the nearby Goreme valley—known as Petrified Valley—there are 365 churches with whimsical names such as Slipper Church and Buckle Church, scooped out of solid rock and decorated with remarkable frescoes. Even the columns have been shaped and hewn from the soft volcanic rock. We visit the picturesque villages of Cavusin, Heden and Avanos, famous for their onyx and beautiful old houses. From the ancient citadel of Uchisar, we have a spectacular view of Petrified Valley. B/L/D

Wed 25 Cappadocia/Konya/Alanya. We depart early this morning for the drive to the Plain of Konya, a cradle of civilization and one of the oldest continuously inhabited sites in Turkey. Known as Iconium in Roman times, Konya was the capital of the Seljuk Turks in the 12th and 13th centuries. . . and one of the greatest culture centers of its time. It was during this period that the Moslem mystic Mevlana Celaleddin Rumi founded the set of the Whirling Dervishes, an order based not on fanaticism, but on universal faith and love. The former dervish seminary attached to the Mausoleum is now a museum, devoted to manuscripts of Mevlana's works, and to other articles belonging to the order. Since this is a full day's overland journey, we take lunch and dinner on the road, arriving at our hotel—the **Serapsu**—in Alanya this evening. B/L/D

Thu 26 Alanya/Side/Alanya. This morning is free to allow you to enjoy the swimming and shopping facilities at the Serapsu Hotel. We leave this afternoon to explore the ancient city of Side and its remarkable monuments. Side (the Turkish word for pomegranate) was an ancient Turkish harbor that has made a graceful transition into a lovely resort village today. Its popularity is due not only to its hotels, restaurants, beaches, shops and sea views, but also to the many archaeological ruins that permeate this ancient settlement. This still-active theater of the ancient city, built on colonnaded arches next to an agora (ancient marketplace), is the largest in the area, seating 25,000. The creamy white columns of the Temple of Apollo are a striking contrast to the blue sea below; and the extensive Roman Bath, now a museum, houses one of Turkey's finest archaeological collections. At the museum, we see many of the priceless statues uncovered during the city's excavation. B/D

Fri 27 Alanya/Perge/Aspendos/Antalya/Alanya. Our first stop this morning is at the Pamphylian city of Perge, where St. Paul preached his first sermon. Next will be Aspendos, where we see the best-preserved theater of antiquity, dating from the second century A.D. Its acoustics are still magnificent. Our route takes us to Antalya, the heart of the "Turkish Riviera," set on the perfect crescent of the Mediterranean's Konyalti Beach. Antalya's incomparable beauty makes it a paradise on earth; year-round, the slopes of the Toros Mountains are blanketed in green forests that dip to the sea, forming an irregular coastline of rocky headlands and secluded caves of clear turquoise water. This area is rich in history, interwoven with legends that go back as far as the Paleolithic Age. It was here that Bellerophon slew the fire-breathing Chimera; where the nymph Daphne was turned into a bay tree by Zeus to save her from Apollo's amorous advances; and this was the home of St. Nicholas, our own Santa Claus. Before returning to Alanya and the **Serapsu Hotel,** we have the opportunity to enjoy lunch on our own at one of the many restaurants in Antalya's lovely harbor area. B/D

Sat 28 Alanya/Pamukkale. Pamukkale (Cotton Castle) is a beautiful and spectacular natural site unique in the world. It is a fairylike, dazzling white petrified cascade falling from a height of 100 meters. Thermal spring waters, laden with calcareous salts running off the plateau's edge, have created this fantastic formation of stalactites, cataracts and basins. The thermal waters have been used since Roman times for their therapeutic powers. Situated on the plateau are both the modern thermal center and the ruins of the ancient cemetary of Hierapolis. Lunch is served by Lake Egridir. Dinner is at our hotel in Pamukkale, the **Tusan Hotel.** B/L/D

Sun 29 Pamukkale/Aphrodisias/Ephesus/Izmir. The fabled city of Aphrodisias—the home of the greatest sculpting schools of antiquity—has not yet been fully explored; every year new and important areas and finds are being uncovered. After lunch, we drive on the Ephesus, one of the most important sites in Christendom, of which St.Paul asked "Is there a greater City?" Here, side by side with Moslem treasures such as Isa Bey Mosque, we find the basilica of St. John and the house of the Virgin Mary. We visit Odeon, the Arcadian Way, where Mark Antony and Cleopatra once rode in procession, the Gate of Magnestia, the Temples of Hadrian and Serapis, the Marble Street, the Great Theater where St. Paul argued against the Ephesian goddess Arteis, and the agora. Here, too, are the ruins of the fabled Temple of Diana, one of the Seven Wonders of the Ancient World. We overnight this evening at Izmir, in the deluxe **Buyuk Efes Hotel.** B/L

Mon 30 Izmir. Izmir, once known as Smyrna, is a pearl of myth, the birthplace of Homer, a beautiful modern city in the ancient region encompassing such historic sites as Ephesus, Pergamum, Troy and Sardis . . . the region that played the greatest role in developing all the major religions, from Islam to Christianity. Overlooking the city of Mount Pagus, is Kadifekale, the "velvet castle," built by a general in the army of Alexander the Great. We visit Kadifekale this afternoon, for a phenomenal view of the city, then head on to the agora, the International Fairgrounds, the Archaeological Museum and the Bazaar. B

Tue 31 Izmir/Pergamum/Canakkale. Leave Izmir for Pergamum, a center of learning and the arts, with a library of antiquities that contains over 200,000 volumes. Here we visit Asclepion, the Red Basilica Pergamum Acropolis, the Athena and Trojan Temples, the Library, the Great Theater, the Temples of Dionysos, Hera and Demeter, and the agora. Other highlights in this masterful storehouse of Greek and Roman history are the Gymnasium of Youth, the Odeon, the Roman Baths, the Hellenistic Gate and the Temple of Zeus. We continue to Canakkale and the **Tusan Hotel**, Troy's finest. B/L

NOVEMBER, 1989

Wed 01 Canakkale/Troy/Istanbul. The legends of Helen of Troy and the epic heros of the Trojan Wars will come to life as we visit the ancient city that was the home of Paris, who incurred the wrath of the Greeks by seducing the sister-in-law of King Agamemnon. Later, after a seafood lunch, we leave for our final destination—Istanbul—arriving at the posh western-style **Sheraton Hotel** in the afternoon. B/L

TOUR COSTS FROM CHICAGO:

- Land per person sharing room: $2,509
- Single room supplement: $400
- Round-trip economy airfare, (departure tax not included) $1,311

Above cost includes $200 tax deductible donation to Field Museum of Natural History.

Total: $3,820

Thu 02 Istanbul. Istanbul is a city that spans two continents . . . 2600 years . . . and many cultures. Divided by the magnificent Bosphorus, the waterway between Asia and Europe, Istanbul's classic beauty was best described by Lamartine: "There God, man, nature and art have together created and placed the most marvelous view that the human eye can contemplate on earth." Once known as Constantinople, Istanbul was the roman capital of the Emperor Constantine, and held sway over an empire that stretched from the Gates of Vienna to the Persian Gulf. When the Holy Roman Empire was divided, the city became the Byzantine capital until, in 1453, it fell to the Ottoman Turk armies of the young Sultan Mehmet II. Our tour today includes a kaleidoscope of wonders: the famous Blue Mosque with its six minarets and haunting blue Iznik tiles, the imposing Mosque of Suleyman the Magnificent built by Sinan, the greatest Turkish architect who ever lived, the Archaeological Museum which houses the sarcophagus of Alexander the Great, and 6th-century St. Sophia built by the emperor Justinian to be the grandest çhurch of Christendom. After lunch at the Konyali Restaurant on the grounds of the Topkapi Palace, we explore the fabulous exhibits of the mysterious labyrinthine palace itself: jewel-encrusted thrones, common kitchen implements fashioned from pure jade, the jewelled dagger that ws featured in the film. Topkapi," the immense Harem quarters, the brilliant 84-carat Spoonmaker's Diamond, the alleged hand of John the Baptist, and many relics of the prophet Mohammed. Finally, before returning to the hotel, we visit the incredible Grand Covered Bazaar, a treasure trove of jewelry, beaten copper vessels, exotic spices, suede coats, fine embroidery and a virtual rainbow of Turkish carpets. Whatever you seek is on sale here, in staggering quantity and profusion; and every merchant is willing to negotiate over a glass of tea or lemonade. All about us are shoe-shine boys, snake charmers, flavored-ice vendors and a cacophony of sounds and smells that will make our senses reel. In the evening we enjoy a dinner-cruise on the Bosphorus.

Fri 03 Istanbul. Much of Istanbul's importance comes from her strategic location on the Bosphorus, the gateway from the Mediterranean to the Black Sea; and many of her finest palaces and homes are spread along this waterway that divides the city. Today's mini-cruise takes us along both the European and Asiatic shores of the cypress-lined Bosphorus to see her many wonders, including the wooden Ottoman villas known as "Yalis" in the village of Yenikoy. We disembark on the Asian side for lunch and a visit to Beylerbeyi Palace—the personal retreat of Sultan Abdu Aziz—before continuing into the Camlica Hills for a stunning view of all Istanbul: the city, the islands, the Sea of Marmara, the Bosphorus and the hinterlands of Asia. In the evening we enjoy a festive dinner show at the Kervansaray Night Club. B/L/D

Sat 04 Istanbul/Zurich/Chicago. In the early morning our homebound flights leave Istanbul via Pan American and Swissair. We arrive Chicago in mid-afternoon.

To lead our journey, we have selected Dr. David S. Reese, a graduate in anthropology from Harvard who received his Ph.D. in archaeology from the University of Cambridge. Dr. Reese has extensive excavation experience in the Mediterranean.

Southwestern China Cultural Relics Study Tour

September 15 - October 6

Leader: Katharine Lee Yang

Price: $4,500

For reservations, call or write Dorothy Roder (322-8862), Tours Manager, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, Il 60605

Field Museum of Natural History
Membership Department
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FIELD MUSEUM
THE SMART WAY TO HAVE FUN.

FIELD MUSEUM OF NATURAL HISTORY BULLETIN

July/August 1989

BIENNIAL REPORT 1987-1988

Field Museum of Natural History Bulletin

Published since 1930 by
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Founded 1893

Editor/Designer: David M. Walsten
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EVENTS

World Music Programs

Weekends in July and August
1:00pm and 3:00pm

Program Highlights include:

☐ *July 1 & 2*

1:00pm—Ari Brown plays blues saxophone
3:00pm—Librado Salazar plays classical guitar

☐ *July 8 & 9*

1:00pm—Chinese Music Society of North America demonstrates instruments from the Chinese orchestra
3:00pm—Raices del Ande performs Bolivian and Latin American folkloric music

☐ *July 15 & 16*

1:00pm—Eli Hoenai demonstrates African percussion
3:00pm—Keith Eric performs Jamaican music and tells stories

☐ *July 22 & 23*

1:00pm—Rita Warford presents jazz vocals
3:00pm—Keith Eric performs Jamaican music and tells stories

☐ *July 29 & 30*

1:00pm—Thunder Sky Drummers play African percussion
3:00pm—Amira demonstrates the shakere

☐ *August 5 & 6*

1:00pm—Eli Hoenai demonstrates African percussion
3:00pm—Raices del Ande performs Latin American folkloric music

☐ *August 12 & 13*

1:00pm—Rita Warford presents jazz vocals
3:00pm—Douglas Ewart plays Japanese and Australian flutes

☐ *August 19 & 20*

1:00pm—Thunder Sky Drummers perform African percussion instruments
3:00pm—Librado Salazar plays classical guitar

☐ *August 26 & 27*

1:00pm—Chinese Music Society of North America demonstrates selected instruments from the Chinese orchestra
3:00pm—Chicago Beau plays blues harmonica

The World Music Program is supported by the Kenneth and Harle Montgomery Fund and a CityArts grant from the Chicago Office of Fine Arts, Department of Cultural Affairs, and the Illinois Arts Council, a state agency. These programs are free with Museum admission and tickets are not required.

Weekend Programs

EACH SATURDAY AND SUNDAY you are invited to explore the world of natural history at Field Museum. Free tours, demonstrations, and films related to ongoing exhibits at the Museum are designed for families and adults. Listed below are some of the numerous activities offered each weekend. Check the activity listing upon arrival for the complete schedule, and program locations. The programs are partially supported by a grant from the Illinois Arts Council.

July
15,29 12:30pm *"Museum Safari"*
Trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon, big game from Africa and seals from the Arctic.

July
22 1:30pm *"Tibet Today,"* and Tour of Collection
Experience Tibet in this slide lecture about this mountain nation, followed by a tour of our Tibet exhibit.

August
5,19 12:30pm *"Museum Safari"*
Trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon, big game from Africa and seals from the Arctic.

August
12 1:30pm *"Tibet Today and Bhutan: Land of the Thunder Dragon."*
See Lhasa and other towns now open to tourists, and examine important Buddhist sites during this slide lecture and tour.

These programs are free with Museum admission and tickets are not required.

Children's Workshops

A FEW SPACES ARE STILL AVAILABLE in this summer's children's workshops. Children ages 4-13 can explore the exciting world of natural history in these workshops. Enrollment is limited and advance registration required. See the June/July/August Program brochure for workshop details. Call (312) 322-8854, Monday-Friday, 9:00am-4:00pm for space availability.

FROM THE CHAIRMAN

Bachrach

As the Museum nears its 100th birthday, its work becomes ever more important and urgent. We are aided in this task by generous friends from both the private and public sectors. "Time Future from Time Past" was the theme of the $40 million capital campaign which you oversubscribed. Your contributions of time, money, and private collections have exceeded our expectations. We are grateful for that, and we believe you can be proud of the work your efforts have supported.

Our 1986 strategic plan, *Centennial Directions,* mandates that the Museum perform two basic functions. As a research institute it collects, catalogs, and analyzes flora and fauna and artifacts from human cultures worldwide—19 million specimens so far—and makes this knowledge available to the scientific community. Then, in the public museum, it groups and displays these objects in interpretive exhibits. The common denominator of the Museum's collection and research activities and its work in public education is perhaps best expressed by John Muir's observation: "When we try to pick out anything by itself, we find it hitched to everything else in the universe."

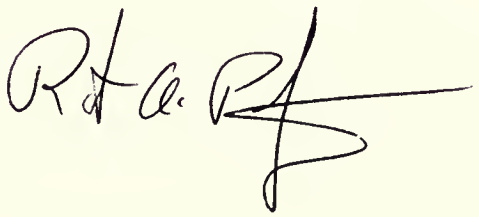
Because Field Museum recognizes just how "hitched" we are to all other species inhabiting this planet, our scientists are leaders in conservation biology. Civilization long ago stripped the world's temperate regions of natural habitats that were home to millions of species, and now this process of destruction is under way at the poles and in the tropics. Field Museum researchers are in the forefront of efforts to find, identify, and preserve as many of these species as possible before their habitats are destroyed.

Other research groups in the Museum have been working on problems in geology and anthropology that also involve the diversity and interrelationships of species and cultures. In the new paleomagnetism laboratory, our scientists are exploring how evolution is affected by the changing face of the Earth itself, as continental drift has separated creatures from their cousins and native environments. Likewise, our anthropologists study evolution as they examine the nature of sociocultural change and stability, and the origins of ethnic diversity.

Like the research departments, the public museum focuses on diversity—not only in presenting displays of the diversity of the natural world and human cultures, but also in creating programs to meet the needs and interests of a diverse public. *Centennial Directions* gave us a plan for doing that, and visitors can see the results in the dramatic changes that have taken place in the Museum's physical appearance and exhibits.

By the time of the Museum's centennial in 1993 we expect that the Museum will have much to celebrate. We will celebrate not only what the Museum has done, but its vital future role—to advance both our knowledge of the natural world and a public spirit of protectiveness toward the living planet to which all our futures are hitched. The Museum's vast systematic collections will serve as an invaluable resource in assessing and addressing the growing challenges of biodiversity.

You have bought the biosphere a little more time by investing in your Museum. What we have done with those resources in the past two years is set forth in the report that follows. I can only add that the enthusiastic and imaginative ways in which the staff and volunteers have responded to the challenges of *Centennial Directions* give me great confidence that we can maintain the momentum into the Museum's second century.



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The new informal exhibit *Sizes* invites visitor participation. The special construction of this room, viewed through a window, creates the illusion that these men, of nearly the same size, are of midget and giant proportions. Ron Tesla 84952-17

THE PUBLIC MUSEUM

While every department of the Museum, from housekeeping to scientific support services, has had to change to meet the challenges of *Centennial Directions,* most of that change has been invisible to the public. Not so the dramatic reorganization underway in the public museum. Anyone returning for a visit after an absence of several years will immediately notice the difference.

The plan called for development of a multi-tiered system of exhibits designed to serve the distinctly different needs of the Museum's many constituencies—family groups and tourists, schoolchildren and teachers, scholars and serious amateurs, and, not least, those nonvisitors for whom the Museum's hushed formality has been a barrier.

Informal Exhibits

Representative elements of the new system are now in place. A visitor walking into Stanley Field Hall will find the once-imposing physical grandeur softened by the expanded Museum shop and lively exhibits filling the arcade spaces on either side. These *informal exhibits* cover single-concept, nonsequential themes, designed to lure the casual visitor into direct, challenging experiences. The exhibits rely heavily on interactive models, functional replicas, and expendable materials. They are engaging, playful, sometimes messy, noisy, and bright.

The tone was set on October 10, 1987, with the opening of the first of the informal exhibits, *Sizes,* which explores concepts of biomechanics and scale. Step right up, folks. Test your jumping skill against a flea! Try on Levi's largest off-the-rack jeans! In short, put yourself in the other creature's shoes.

Major Thematic Exhibits

As visitors move deeper into the Museum, they will encounter *major thematic exhibits.* These are not traveling spectaculars like 1977's Treasures of Tutankhamen but more permanent installations drawing on materials and

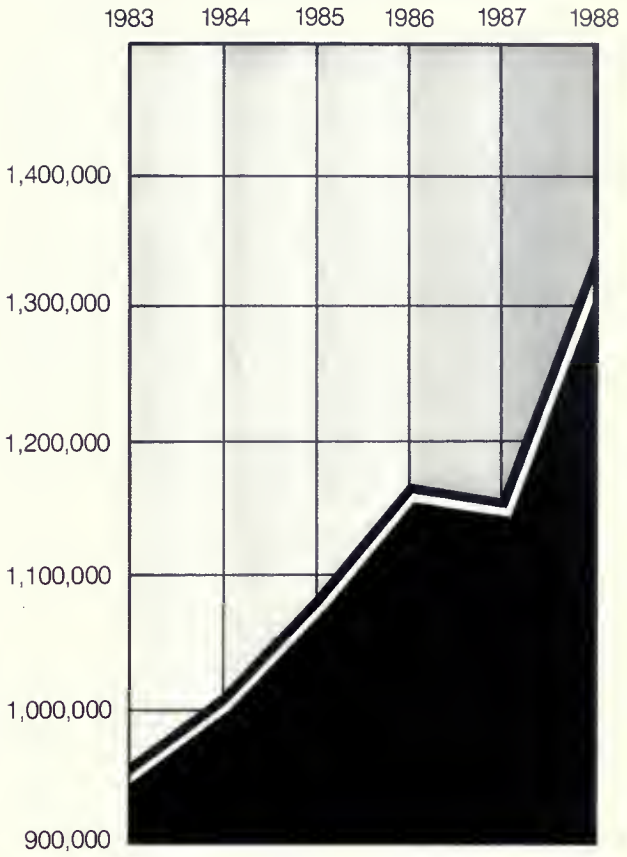
ideas from several Museum departments and collections, and are intended to present sequential topics in dramatic and memorable form.

The emphasis is on displaying collections, conveying information, and stimulating thought. The settings are carefully designed environments that include controlled lighting, sound, and climate. While they reflect the strengths of Field Museum collections, they also make use of models, dioramas, media, simple interactive devices, and provocative labels.

The first major thematic exhibit, *Inside Ancient Egypt,* opened to the public November 11, 1988. The Museum's extraordinary collection of Egyptian artifacts, assembled by Edward Ayer over a number of years beginning in 1894, has been arranged to tell the story of everyday, court, and after life during more than 3,000 years of dynastic rule. Beginning with a walk through two of the actual rooms from the mastaba of Unis-Ankh set in a replica of the original tomb complex, the visitor climbs to the roof, then descends the thirty-five-foot burial shaft to the looted burial chamber below. Other highlights of the exhibit include a Nile marsh diorama with living papyrus and a working *shaduf,* or water-lift; a rare funerary boat; a village shrine to the cat goddess Bastet; a lively marketplace; and twenty-three actual mummies, whose wrappings were specially conserved for this appearance.

One of several hands-on activities in the new permanent exhibit, *Inside Ancient Egypt.* Here, visitors try the *shaduf,* or water-lift.

Field Museum Attendance 1983-1988



The second major exhibit, on the Pacific Islands, is scheduled to open in two parts in 1989 and 1990; a third, on Africa, is in the planning stages; Museum staffers have been consulting African and African-American communities in the Chicago area for their ideas on what might make this exhibit more meaningful and powerful.

Resource Centers

Occupying the outermost ring of public spaces, but immediately adjacent to the thematic exhibits, *resource centers* afford the intrigued casual visitor or advanced user an opportunity for concentrated, in-depth, and detailed exploration of the Museum's collections. In comfortable, informal, library-like spaces with lots of seating and natural lighting from windows that open onto the park, visitors have access to study collections, educational kits, books and periodicals, photo archives, videotapes, recordings, and computer databases. Helpful staff and volunteers facilitate access to resources both at the Field Museum and at other Chicago-area institutions.

The first resource center opened June 27, 1987. Focusing on native peoples of the Americas, it was named

in honor of E. Leland Webber, director and president of the Museum for many years. Reference materials expand on the "Indians of the Americas" exhibits in the surrounding halls. Visitors have made especially heavy use of a collection of videotapes, albums of prints from the Museum's extensive archive of ethnographic photos, experience boxes from the Harris Educational Loan Center, and tribal newspapers through which Native Americans speak from their own perspective of current issues.

Special Exhibits

In 1987 and 1988 the Museum opened two additional spaces for special exhibits, the Webber Gallery located in the Webber Resource Center and a small gallery on the ground floor next to the larger Special Exhibition Hall that has housed *Gods, Spirits, and People* since 1986. The new spaces permitted a significant increase in temporary exhibits; during the past two years the Museum hosted seventeen traveling exhibits and also mounted three shows generated in-house.

Recent acquisitions to the Field Museum's anthropology collection provided artifacts for two of the special in-house exhibits. *Traditions in Japanese Art: The Boone Collection* included a broad spectrum of items spanning the Edo through Meiji periods. Paintings, maps, books, ceramics, personal accessories, household furnishings, and textiles donated by Katharine and the late Commander Gilbert E. Boone comprised the exhibit which was on display June to October 1988. In addition, Japanese inro, netsuke, and ojime donated by Jeanette and Carl Kroch have been exhibited in a special display adjacent to the ground floor Special Exhibition Hall since November 1987.

The Museum's most spectacular special exhibition of the past two years was certainly *Tiffany: 150 Years of Gems and Jewelry,* mounted in the Hall of Gems and Grainger Gallery for three months starting November 7, 1987. The exhibit traced the evolution of jewelry design in America through the history of the famous jeweler.

The exhibit *Celebrating Our Diversity,* a collection of artifacts from the Department of Anthropology, was displayed at Oak Woods Cemetery Association in 1988 as a memorial to the late Mayor Harold Washington.

EDUCATION PROGRAMMING and COMMUNITY OUTREACH

Field Museum's educational programs are designed to augment, refresh, and bring new ideas into the life of our diverse audiences. Under the impetus of *Centennial Directions,* the Education Department has been experimenting with a variety of programs to bring objects, ideas, and learners together in stimulating and useful exchanges.

For the casual visitor as well as the more focused user, we offered a rich variety of courses, workshops, performances, and participatory activities. More than 10,352 people enrolled in multi-session evening or weekend adult courses, participated in Chicago-area environmental field trips, or took part in Summer and Winter Fun children's workshops. Public presentations included performances, lectures, and adult feature courses that highlighted Field Museum's research in the tropics, Indians of the Great Lakes, and Egypt.

For the casual visitor, the relocated Place for Wonder made it possible for parents and younger children to share the delights of touching and exploring natural history materials. Others experienced the replica 1850 Pawnee Earth Lodge, listened to local professional musicians in the World Music Program, or participated with Hall Interpreters in more than 45 hands-on activities.

School and community groups account for one-fifth of the Museum's total annual attendance. *Centennial Directions* outlines our responsibility to extend the benefits of these excursions by increasing training programs for teachers and community group leaders, working with these teachers to improve understanding of the significance of object-based learning on the total educational experience, and developing more resource materials for use away from the Museum.

Thus, training for teachers and community leaders has become a major component of the Museum's work. In 1987-88, some 2,150 teachers and student-teachers participated in 96 training sessions, some for two-week periods and others for one-day workshops. These sessions are followed by participant evaluation and program modelling for future field trips. The entire 8,000-copy first printing of the Museum's new publication *Teach the Mind,*

Tenth anniversary of the Pawnee Earth Lodge in 1988 included visits by Oklahoma Pawnee Indians, who shared their rich cultural heritage with visitors.

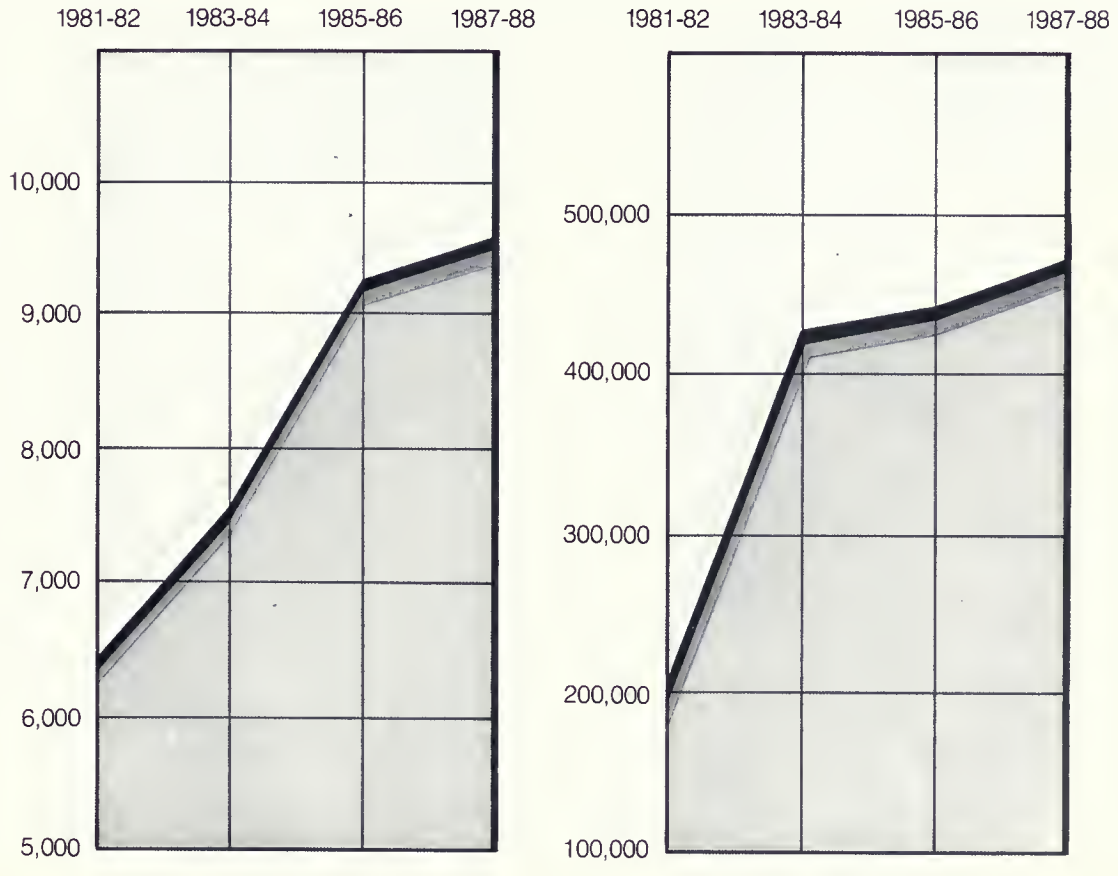
Touch the Spirit: A Guide to Focused Field Trips was exhausted by year's end and the book was reprinted. In addition, 2,966 teachers borrowed 8,893 mini-exhibits and experience boxes free of charge from the Harris Educational Loan Center.

Centennial Directions took note of the fact that for a variety of reasons many suburban and inner-city residents never use the Museum. The Community Outreach program, begun in September 1988, organizes workshops on natural history and cultural themes and provides educational materials and staff training in Chicago Park District field houses, churches, youth clubs, and other facilities in six south-central urban neighborhoods. Advisory committees from these communities will organize annual Neighborhood Nights at the Museum.

In total, 7,272 programs were presented to 795,012 individuals during this biennium. Much of this would not have been possible without the 163 volunteers, who assist in the Education department. Another 140 volunteers work in other areas of the Museum. Altogether, this volunteer support totaled 85,855 hours, which, in financial terms, could be considered a contribution of over $500,000. More importantly, each volunteer contributes a fresh perspective and provides us with the public's viewpoint of our work.

In recognition of Black History Month, Cameroon performers join us for the African Heritage celebration in Stanley Field Hall.

Educational Groups and Individuals in School Groups Visiting Field Museum 1981-1988



COLLECTIONS and RESEARCH

Ron Testa

The late Timothy C. Plowman (left) with Jack C. Staehle, loyal supporter of botanical research projects. Dr. Plowman, former chairman of the Department of Botany, was the world's leading authority on the plant family Erythroxylaceae.

Centennial Directions assigns five tasks to the research and collections divisions of the Museum: to work with other private and governmental organizations in planning a national strategy that would guide us in adding to the Field Museum's collections; to add selectively to the collections in the areas of the Museum's established strengths through fieldwork, purchases, and gifts in kind; to provide adequate staffing for conservation and management of the collections; to upgrade research equipment, storage facilities, and computer capabilities; and to maintain and build the library.

During the past biennium, progress has been made in each of these areas. A visiting committee of university, museum, and science laboratory leaders reviewed the Museum's collections and research programs in 1987 and concluded that while the collections "represent a major world resource," they "need to be nurtured both by additions and by continuous reinterpretation as our understanding of the evolutionary process grows as the result of advances in earth, planetary, and anthropological sciences."

Certainly our Museum scientists have become more acutely aware these past few years of their role in the rapidly escalating conservation crisis, particularly in the tropical rain forests. Each year an area the size of West Virginia is being denuded of lush jungle, and species not yet named or recognized are disappearing faster than they can be inventoried and protected. The first step in preserving biological diversity must be an inventory of species and an understanding of how they interact with each other and their environment. The Museum is one of only a few institutions with the personnel and resources to make major contributions at every level of the conservation process. While our researchers, of course, work in many other disciplines and areas of the world, it's appropriate to highlight here their timely and urgent assignments in the tropics.

Tropical Botany and Zoology

In 1988, the Field Museum entered into an agreement with Conservation International, formalizing a partnership to promote the understanding and conservation of tropical ecosystems. In Costa Rica, Venezuela, Brazil, Peru, Boli-

via, Madagascar, Chile, the Philippines, and Borneo, Museum scientists have been working with host governments, conservation agencies, and other museums and universities. The Museum seeks to document biological diversity and its significance for conservation on a global scale, promote the use of its unique tropical collections, and collaborate on the training students and professionals in host countries.

Among the Field Museum researchers who contributed important work on the flora and fauna of tropical forests is the late chairman of the Department of Botany, Timothy C. Plowman. His death in January 1989 is much mourned by his colleagues, who have established the Timothy Plowman Fund for South American Research and Travel to assist future generations of tropical botanists. Dr. Plowman was the world's leading authority on taxonomy of the family Erythroxylaceae, which includes coca, and he collaborated closely with ethnobotanists working to identify plants known to heal, feed, and house indigenous peoples. The Museum's large and historically significant collection of plant-derived waxes, oils, herbs, medicines, woods, fibers, seeds, and bark, including many items no longer produced in the modern world, has been renamed the Timothy Plowman Economic Botany Collection.

In Venezuela's Orinoco Basin, extensive deforestation and river diversion threaten the habitats of numerous fish communities, and the Museum's associate curator of fishes, Barry Chernoff, has contributed detailed data from his studies of South American freshwater fishes in hopes that a management plan can be devised to save them. Similarly, Lawrence Heaney, recently appointed assistant curator of mammals, has been working in the Philippines, where his data on rare and increasingly endangered species is being used to redesign the national park system.

Scott Lanyon, associate curator of birds, led expeditions to Bolivia, Jamaica, Puerto Rico, and Venezuela to track the biochemical, morphological, and behavioral evolution of the New World blackbirds. Lanyon was recently appointed representative of the American Ornithologists' Union to the International Council for Bird Preservation. John Fitzpatrick, chairman of the Department of Zoology, who has been inventorying bird communities in Peru, visited Madagascar to investigate the possibility of conducting similar studies in that extremely threatened area.

Other Field Museum scientists working in the tropics include William Burger (botanical studies in Costa Rica), Michael Dillon (vascular plants, Peru), Bruce Patterson (mammalian studies, Chile), and Robert Inger and Harold Voris (amphibians and reptiles, Borneo).

Geology and Paleontology

Understanding evolutionary diversity is also the province of those who study the world of the geological past. That work will be significantly advanced by the new paleomagnetic laboratory developed by John Flynn, associate curator of fossil mammals. During the 4.6 billion years of the Earth's existence, its magnetic poles have changed orientation many times, and fossil-bearing rocks often reveal evidence of their magnetic orientation at the time they were formed. Paleomagnetic comparison of geographically remote specimens can show how the

Nina Cummings 84489

Ron Testa, head photographer, and Diane Alexander White, photographer, record on film one of the Museum's great treasures, a bronze Egyptian cat collected by Edward E. Ayer in 1895. In addition to photographing artifacts and specimens of every description, for record as well as publication, they 'shoot' activities as well: public performances, workshops, formal celebrations, building renovation, and curatorial work in the laboratory and in the field.

Earth's land masses have drifted together and apart over the eons. From such evidence, researchers like Flynn and Lance Grande, associate curator of fossil fishes, are able to track relationships among species that the current configuration of the continents and oceans could not possibly support.

Biochemistry

First-rate research in evolutionary biology is often dependent on biochemical analysis. Currently, most biochemical work by Museum staff and gradute students uses the technique of starch-gel electrophoresis. The state of the art, however, is more advanced, and ornithologist Scott Lanyon, who coordinates the Museum's biochemical systematics laboratories, hopes soon to acquire the full array of futuristic technology: mitochondrial and nuclear DNA sequencing, polymerase chain reaction amplification of DNA sequences, DNA fingerprinting, and DNA × DNA hybridization.

Ethnology and Archaeology

Civilizations come and civilizations go, beneficiaries or victims of climatic change, technological development, pestilence, and war. Aboriginal cultures in the modern world coexist uneasily with Western civilization, and are defeated entirely with the loss of wilderness. Preserving the arts and artifacts of cultures living and dead is vital to understanding what links us to our fellows and our ancestors, and all of us to the living Earth.

The Museum's vast and growing collections in anthropology — more than 600,000 items — thus are the centerpieces of its major exhibits, and conserving them is among the Museum's most important functions. Head of Conservation Catherine Sease took a major step forward in this field in June 1987, when she was preparing for the opening of the new Webber Hall. Sease helped develop relative-humidity modules for exhibit cases, technology that eliminates the need to climate-control entire halls. The Field Museum is the first institution in the U.S. to make

Catherine Sease, head of Anthropology's Conservation Division, and Christine Del Re, associate conservator, together with Egyptology consultant Frank Yurco, examine one of 23 mummies subsequently placed on view in the new *Inside Ancient Egypt* exhibit. "The visible side of conservation," observes Sease," is the work we do for exhibits, but that concerns roughly 1 percent of the Anthropology collections. The remainder of our holdings require both preventive care and treatment too. Conservation at Field Museum is expanding to be able to meet these various needs."

Ron Testa 111068

extensive use of these modules. In 1988 Sease received a grant from the National Endowment for the Arts to continue research on the modules and assess their performance.

Center for Academic Programs

As a result of the Museum's Capital Campaign, three major new scholarship programs were added to the Museum's array of supports for nonstaff use of the collections: the Borg-Warner Robert O. Bass Visiting Scientist Program, the Prince Visiting Scholars Program, and the Lester Armour Family Graduate Fellowship.

In 1987-88, the Scholarship Committee made a total of 87 awards, of which 22 went to exceptional graduate or undergraduate students and the remainder to visiting scientists from around the world, including scholars from Asia, South America, Europe, Australia, and Africa as well as the United States and Canada.

Additions to the Collections

The Department of Botany acquired several important collections from endangered tropical areas in 1987-88. As a result of a program sponsored by the National Institutes of Health, the herbarium received a major collection of plants from Southeast Asian tropical rain forests. The objective of this program, headed by Research Associate Doel Soejarto, is to collect plants that will be tested for substances that might help in treating cancer and AIDS. The herbarium also received major collections of South American grasses and palms that are already revealing several new species.

A longtime and active volunteer in the Department of Anthropology, Carolyn S. Moore, contributed 25 Japanese textile stencils to the Collections. Further anthropological additions included over 700 Japanese paintings, sketches, and art objects from Katharine and the late Commander Gilbert E. Boone, as well as a collection of Japanese inro, netsuke, and ojime from Jeanette and Carl Kroch.

The Department of Zoology's collections were also enriched. The Division of Invertebrates augmented its important collection of land snails. In 1987, Curator Alan Solem traveled by helicopter to survey patches of rain forest in Western Australia. Over 29,000 specimens of land snails were collected, and among these Solem discovered two new genera and about 50 new species. These specimens will greatly assist Solem as he continues to study how these organisms originated and evolved.

The Library

Interns, volunteers, and staff members have devoted considerable effort in the past two years to organizing and processing archival and manuscript collections for use by staff and outside researchers.

The correspondence of Herman Strecker (1836-1901), lepidopterist and dealer in butterfly and moth specimens, comprises nearly 10,000 letters from naturalists around the world concerning entomology and collecting. These papers are rich as well in biographical and general historical information.

The papers of Charles Wake (1835-1910), an anthropologist who made important contributions to early kinship studies, include a document of particular interest to the Library. As librarian of the ethnographic department of the 1893 World's Columbian Exposition, Wake compiled a list of the books in the department's library, noting the donor or lender and including Wake's subject classification of the book. The list is thus of great interest for the history of late nineteenth-century anthropology; and because a considerable portion of the books from the collection were among the earliest accessions to the Field Museum Library, its contents are being checked against the Library's current holdings.

Field Museum of Natural History Library

Year-End Holdings

Library	1984	1985	1986	1987	1988	Percent Growth 1984-88
General	97,191	98,120	99,065	99,957	100,254	3.2%
Anthropology	32,447	33,273	34,028	34,624	35,953	10.8%
Botany	28,428	28,783	29,140	29,562	30,028	5.6%
Geology	32,940	33,302	33,625	33,903	34,973	6.2%
Zoology	32,716	33,204	33,708	34,223	34,798	6.4%
Total	223,722	226,682	229,566	232,269	236,006	5.5%

1988 Use of Collections (in volumes)

Library	Museum Staff	Public Visitors	Interlibrary Loans
General	1,558	872	224
Anthropology	1,048	649	115
Botany	311	109	74
Geology	482	147	61
Zoology	420	448	167
Total	3,819	2,225	641

DEVELOPMENT

To maintain its position as a major international research center and as one of the world's great public museums, the Field Museum must constantly earn the interest and loyalty of its many support constituencies. However excellent it may be, the Field Museum is but one of several national institutions in its class, and one of many worthy organizations to which talented citizens might be asked to devote their time and money. *Centennial Directions* sets the task of the Development Department to move "beyond fund raising" into "institutional advancement," a long-range effort to identify the varied interests of current and potential leaders, volunteers, members, and donors and to target programs and activities that will attract and hold them as Museum advocates.

Meanwhile, of course, plain old fund raising has its uses, especially in the midst of a campaign to raise $40 million in new capital. "Time Future From Time Past," the three-year Capital Campaign, concluded on December 31, 1987 with a record $43.3 million in the till. Among the significant contributions to the Campaign was the largest single family gift to the Museum in recent history—$2.5 million from Mr. and Mrs. William L. Searle for unrestricted use. The oversubscription of the Capital Campaign has enabled the Museum to undertake the renewal of programs and physical plant necessary to open the doors on its second century. A listing of 1987-88 donors is on page 30.

With the end of the Capital Campaign, Vice President for Development Thomas R. Sanders announced his retirement, effective January 31, 1989, after twenty years with the Museum. Leo F. Mullin became chairman of the Development Committee of the Board of Trustees, succeeding Richard M. Jones.

The Founders' Council

The Founders' Council, consisting of the Museum's principal individual, corporate, and foundation donors, was organized in 1983 and celebrated its fifth anniversary in 1988 with a dinner at which the Council's Award of Merit was presented to Sir David Attenborough, the naturalist and documentary filmmaker. Henry T. Chandler completed two years as chairman in 1987 and was succeeded by co-chairs Robert and Brooke Kolar.

The Women's Board

Women's Board activities during the biennium raised substantial funds for the Museum while calling attention to significant exhibitions. The Tiffany Ball on November 6, 1987, chaired by Mrs. P. Kelley Armour, marked the opening of the Tiffany exhibit in the Grainger Hall of Gems, which itself marked the jeweler's 150th anniversary. More than 1,000 guests attended. A year later, on November 4, 1988, the Egyptian Ball, chaired by Mrs. John W. Madigan and underwritten by Mr. and Mrs. David W. Grainger, also attracted some 1,000 guests for a preview of the new permanent exhibit *Inside Ancient Egypt*.

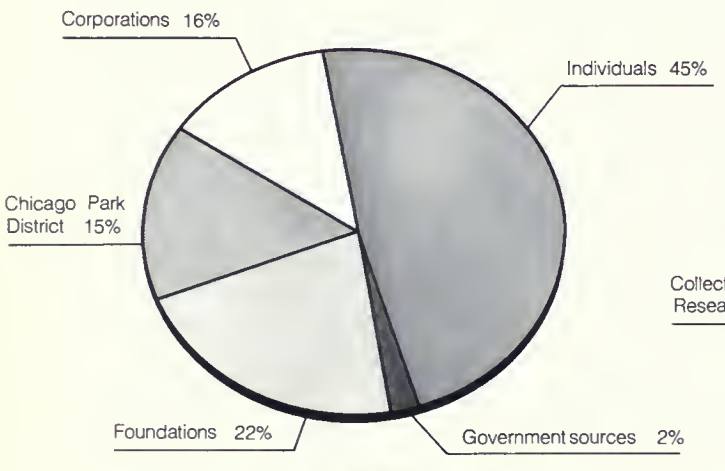
The annual Family Christmas Tea was chaired in 1987 by Mrs. Harrington Bischof and in 1988 by Mrs. Robert Fesmire. The traditional holiday event for Museum members, friends, and their families brings 1,500 guests to Stanley Field Hall for refreshments, music and entertainment.

Mrs. Malcolm N. Smith completed her two-year term as president of the Women's Board in May 1988 and was succeeded by Mrs. James T. O'Connor.

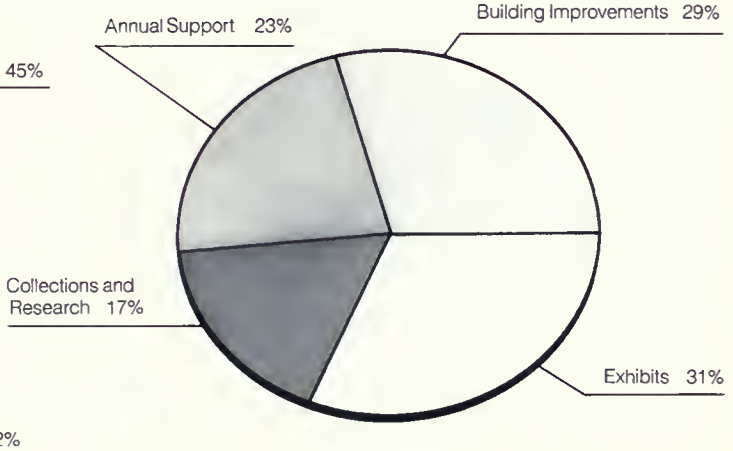
The Public Programs Support Group

The Public Programs Support Group (PPSG) was organized in 1987 for talented and diverse young professionals interested in the Museum's new directions in public programs. The group spent its first two years building a membership base, establishing objectives, and determining its role in the Museum's future. PPSG provided valuable advice and contacts for the Museum during the development of its most ambitious neighborhood program, Community Outreach. The group's primary function in the coming years will be raising funds and serving as volunteers

Capital Campaign, "Time Future From Time Past"– 1984-1987



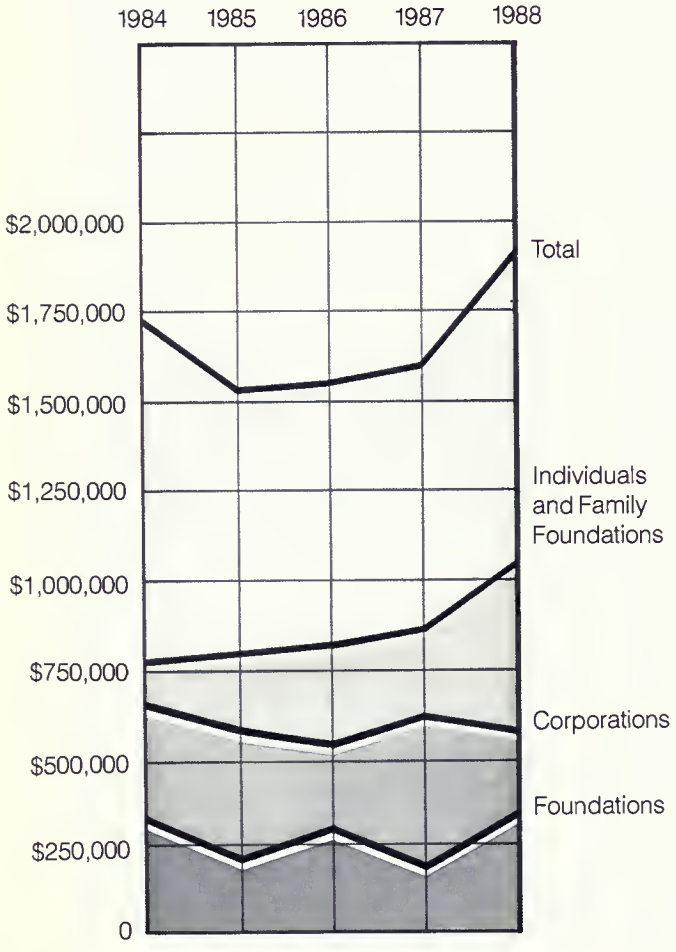
Sources $43,000,000



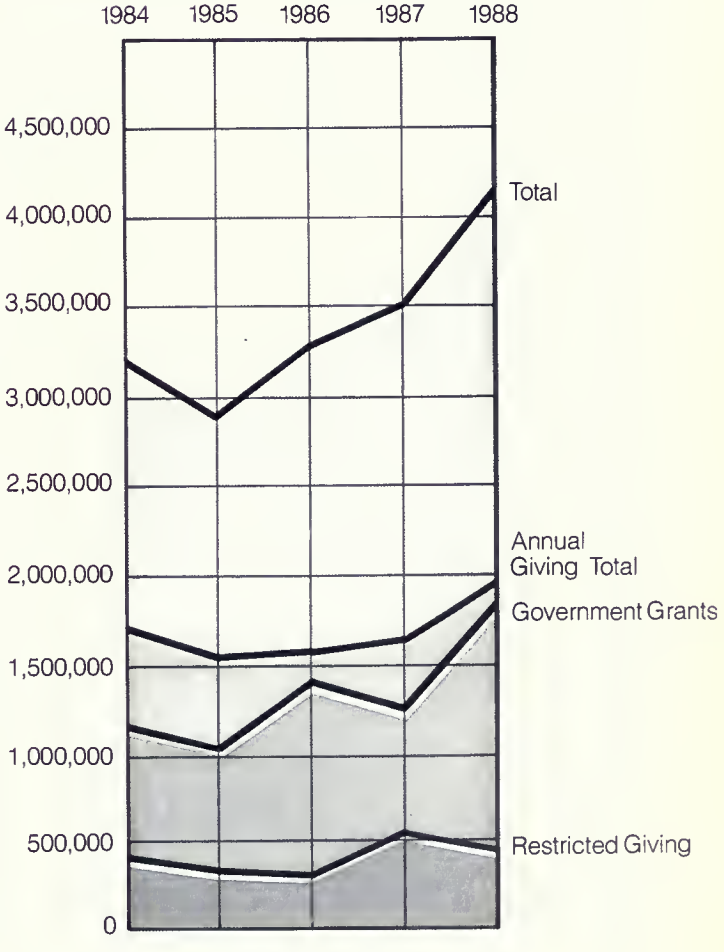
Destination $43,000,000

Philip Harris, chairman of the Public Programs Support Group. "The PPSG," says Harris, "is committed to providing Field Museum with financial and human resources which will contribute to the Museum's efforts to reach out to a more diverse public."

Annual Unrestricted Giving 1984-1988



Total Giving 1984-1988



DEVELOPMENT

Shown at the Women's Board Egyptian Ball in November 1988 are (l. to r.) Mrs. Lester Armour, Field Museum president Willard L. Boyd, and Museum trustee Mrs. T. Stanton Armour.
Dave Rundell photo

for the Community Outreach Program, which is designed to reach a broad spectrum of local residents—particularly the city's ethnic and economically disadvantaged communities.

Tours

During the biennium the Tours Department conducted a wide range of exciting tours, including a voyage to Patagonia and Cape Horn, an extraordinary exploration of China, and a Kenya/Tanzania safari. Many enthusiastic travelers participated in the twelve different excursions led by Field Museum curators. Several special tours were offered to Founders' Council members—a birding trip to the east coast of Maine, a tour of Boston that included a visit to the Ramesses Exhibit, and a tour to the Galapagos Islands with an optional extension to Peru. The travel groups enjoyed expanding their cultural experiences, increasing their awareness about natural history topics, and benefiting from the expertise of Field Museum specialists.

Founders' Council co-chairs Brooke and Bob Kolar. William Burlingham photo

PUBLIC RELATIONS

The challenge of *Centennial Directions* to the Museum's public relations and marketing staff—"to attract more visitors . . . and to broaden their use of the Museum's resources"—was met with coordinated publicity, promotion, and advertising campaigns that increased Museum attendance from 1,165,027 in 1986 to 1,332,707 in 1988, a year that included the highest single day's attendance (15,845 on December 29) since the 1933 World's Fair (65,966 on August 24).

A major effort to promote *Inside Ancient Egypt* resulted in extensive media coverage throughout the United States and in at least 79 foreign countries. KLM Airlines, Pizza Hut, the Illinois Office of Tourism, major Chicago retailers, banks, and hotels joined with the Museum to promote major exhibits and programs. The department participated in 18 major city and community festivals, distributing 570,000 Field Museum brochures. The annual "Spend a Day with Us" campaign successfully promoted the Field Museum, Shedd Aquarium, and Adler Planetarium as a travel destination for suburban and midwest visitors.

A spring 1988 radio advertising campaign promoting the new *Sizes* exhibit was capped with an on-site appearance by Dave Corzine, the tallest member of the Chicago Bulls basketball team. Attendance increased dramatically during and immediately after this campaign.

The Five-Year Plan

Working with a team of senior advisors from the Leo Burnett U.S.A. advertising agency, the department has developed a comprehensive five-year marketing plan designed to build annual attendance to 2.1 million by 1993 and to generate substantial new revenues for the Museum. Year One of the plan is 1989; the theme is "Field Museum—the Smart Way to Have Fun."

Olive Pierce © 1986

"Mothers and Daughters," a collection of photographs on view January through March 1988, was among 17 traveling exhibits during the biennium.

FIELD MUSEUM
THE SMART WAY TO HAVE FUN.

FIELD MUSEUM OF NATURAL HISTORY

Statements of Assets, Liabilities and Fund Balances

December 31, 1988 and 1987

	Unrestricted fund		Board designated fund	
Assets	**1988**	**1987**	**1988**	**1987**
Cash	$ 625,724	$ 1,079,401		
Accounts receivable	438,949	571,458		
Pledges receivable	165,750			
Museum stores' inventory	1,115,051	970,716		
Prepaid expenses:				
Pension cost	371,923	10,878		
Other	85,771	104,479		
Deferred charges:				
Note issuance costs				
Other	195,581	78,435		
Investments	2,339,338	1,275,475		
Collections	1	1		
Museum property	7,136,866	7,136,866		
	$12,474,954	$11,227,709		
Liabilities and Fund Balances				
Accounts payable	$ 1,593,259	$ 1,056,948		
Accrued liabilities	351,301	404,972		
Accrued pension contribution	330,553			
Deferred revenue:				
Contributions				
Other	381,227	218,220		
Note payable				
Due to (from) other funds	775,893	546,376	($3,284,675)	($2,475,824)
Total liabilities	3,432,233	2,226,516	(3,284,675)	(2,475,824)
Museum property fund balance	7,136,867	7,136,867		
Fund balance	1,905,854	1,864,326	3,284,675	2,475,824
Total fund balance	9,042,721	9,001,193	3,284,675	2,475,824
	$12,474,954	$11,227,709	$ —	$ —

Restricted fund		Fund functioning as endowment		Endowment fund		Combined total	
1988	1987	1988	1987	1988	1987	1988	1987
						$ 625,724	$ 1,079,401
$ 573,175	$ 404,968					1,012,124	976,426
4,195,037		$ 200,000				4,560,787	
						1,115,051	970,716
						371,923	10,878
						85,771	104,479
369,580	384,910					369,580	384,910
						195,581	78,435
18,312,566	24,423,657	51,235,841	$44,031,440	$15,490,012	$14,488,013	87,377,757	84,218,585
						1	1
						7,136,866	7,136,866
$23,450,358	$25,213,535	$51,435,841	$44,031,440	$15,490,012	$14,488,013	$102,851,165	$94,960,697
						$ 1,593,259	$ 1,056,948
$ 235,487	$ 180,952					586,788	585,924
						330,553	
6,568,163	6,173,916					6,568,163	6,173,916
37,926	29,219					419,153	247,439
14,100,000	$16,900,000					14,100,000	16,900,000
2,508,782	$ 1,929,448					—	—
23,450,358	25,213,535					23,597,916	24,964,227
						7,136,867	7,136,867
		$51,435,841	$44,031,440	$15,490,012	$14,488,013	72,116,382	62,859,603
		51,435,841	44,031,440	15,490,012	14,488,013	79,253,249	69,996,470
$23,450,358	$25,213,535	$51,435,841	$44,031,440	$15,490,012	$14,488,013	$102,851,165	$94,960,697

FIELD MUSEUM OF NATURAL HISTORY

Statements of Revenues, Expenses and Changes in Fund Balances

Years Ended December 31, 1988 and 1987

	Unrestricted Fund		Board designated fund	
	1988	1987	1988	1987
Revenues				
Chicago Park District property tax collections	$ 5,541,586	$ 5,349,164		
Government grants	443,421	567,497		
Interest and dividend income	3,153,146	3,163,721		
Net realized gain (loss) on investments sold	3,193	16,900		
Net unrealized gain on investments held				
Contributions	1,650,379	1,483,840		
Memberships	611,775	539,280		
Admissions	1,168,267	887,188		
Auxiliary enterprises (museum stores, vending, tours, food services)	2,995,978	2,286,663		
Other	26,943	29,395		
Total revenues	15,594,688	14,323,648	—	—
Expenses:				
Research and collections	3,280,114	2,772,006	$ 126,385	$ 5,270
Public programs	1,041,736	1,550,546	27,245	22,352
Finance and museum services	5,377,310	5,819,682	44,047	102
Development and external affairs	1,320,370	734,933	13,391	36,423
Administration	1,333,511	1,202,709	130,081	6,901
Auxiliary enterprises (museum stores, vending, tours, food services)	2,554,529	1,825,599		
Capital improvement expenditures	114,660	165,453		
Note interest and amortization				
Net unrealized loss on investments held				
Overhead costs charged to grants	(220,820)	(163,530)		
Total expenses	14,801,410	13,907,398	341,149	71,048
Increase (decrease) in fund balance before cumulative effect of a charge in accounting principles, transfers and net unrealized gain (loss) on investments held	793,278	416,250	(341,149)	(71,048)
Cumulative effect of the change in the method of recognizing pledged contributions	398,250			
Increase (decrease) in fund balance before transfers and net unrealized gain (loss) on investments held	1,191,528	416,250	(341,149)	(71,048)
Add (deduct) transfers				
Nonmandatory transfer—Board designated fund	(1,150,000)	(375,000)	1,150,000	375,000
Transfer—Restricted Fund				
Transfer—Fund functioning as endowment				
Transfer—Endowment Fund				
Increase (decrease) in fund balance before net unrealized gain (loss) on investments held	41,528	41,250	808,851	303,952
Fund balance at beginning of year	1,864,326	1,823,076	2,475,824	2,171,872
	1,905,854	1,864,326	3,284,675	2,475,824
Net unrealized gain (loss) on investments held				
Fund balance at end of year	$ 1,905,854	$ 1,864,326	$3,284,675	$2,475,824

Restricted fund		Fund functioning an Endowment		Endowment fund		Combined total	
1988	1987	1988	1987	1988	1987	1988	1987
						$5,541,586	$ 5,349,164
$1,387,092	$ 789,273					1,830,513	1,356,770
2,364,573	2,386,681	$ 12,015	$ 26,466	$ 2,126	$ 4,913	5,531,860	5,581,781
(56,206)	(64,730)	(807,296)	5,036,871	(254,050)	1,629,682	(1,114,359)	6,618,723
280,166						280,166	
908,320	7,269,572	2,645,491	871,058	203,621	606,159	5,407,811	10,230,629
						611,775	539,280
						1,168,267	887,188
						2,995,978	2,286,663
3,978	2,830,700					30,921	2,860,095
4,887,923	13,211,496	1,850,210	5,934,395	(48,303)	2,240,754	22,284,518	35,710,293
1,314,250	939,095					4,720,749	3,716,371
1,262,428	1,269,177					2,331,409	2,842,075
	69,820					5,421,357	5,889,604
	456,726					1,333,761	1,228,082
12,720	95,132					1,476,312	1,304,742
6,281	4,832					2,560,810	1,830,431
7,066,471	8,436,308					7,181,131	8,601,761
849,770	856,461					849,770	856,461
	754,273						754,273
220,820	163,530					—	—
10,732,740	13,045,354					25,875,299	27,023,800
(5,844,817)	166,142	1,850,210	5,934,395	(48,303)	2,240,754	(3,590,781)	8,686,493
7,581,993		375,000				8,355,243	
1,737,176	166,142	2,225,210	5,934,395	(48,303)	2,240,754	4,764,462	8,686,493
							—
25,000				(25,000)		—	
(1,762,176)		1,762,176				—	
	(166,142)					166,142	—
$ —	—	3,987,386	5,934,395	(73,303)	2,406,896	4,764,462	8,686,493
		44,031,440	41,759,474	14,488,013	13,266,108	62,859,603	59,020,530
		48,018,826	47,693,869	14,414,710	15,673,004	67,624,065	67,707,023
		3,417,015	(3,662,429)	1,075,302	(1,184,991)	4,492,317	(4,847,420)
	$	$51,435,841	$44,031,440	$15,490,012	$14,488,013	$72,116,382	$62,859,603

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Karl Dytrych, M.B.A.; *controller*

Accounting

Renay A. Barnes, B.S.; *manager*
Alix M. Alexandre, *accounting clerk*
Darlene Brox, *head cashier—accounting*
Alexander R. Friesel, B.G.S.; *chief accountant*
Christopher L. Gardner, *accounting clerk*

FIELD MUSEUM STAFF

Gregory J. Kotulski, *process specialist—accounting*
Wayne Lacey, B.S.; *accountant*
Vincent O. Osaghae, M.B.A., C.P.A.; *accountant*
Doris S. Thompson, *payroll coordinator*
Dora G. Vallejo, *cashier—accounting*
Deborah A. Williams, B.S.; *accounting clerk*

Purchasing

Thomas W. Geary, B.S.; *purchasing agent*
Lorraine Petkus, *purchasing assistant*

Marketing and Sales

John G. Economos, *director of marketing & sales*

Public Merchandising

Barbara I. Stuark, B.P.H., C.B.A.; *manager*
Betty E. Applewhite, A.A.; *sales clerk*
Robert T. Chelmowski, *sales support assistant*
Gloria Clayton, *sales clerk*
Mary C. Coffey, *sales clerk*
Helen Cooper, *sales clerk*
Kathleen A. Christon, B.S.; *sales clerk*
Luanne I. Dorsey-Olson, B.A.; *sales clerk*
Meseret Gelaw, *sales clerk*
Ernesto Gomez, *sales clerk*
Betty J. Green, *sales support assistant*
Lee T. Hall, *sales clerk*
Kim Michelle Holmes, *sales clerk*
Marie A. Lumpkin, *sales clerk*
Dolores E. Marler, *supervisor*
Diane Kerry Martin, B.A.; *clerk*
Renee L. Medel-Banda, A.A., L.P.N; *sales clerk*
Desariee T. Moore, *sales clerk*
Ciro Olivarez, *sales clerk*
Julia C. Parke, B.A.; *secretary*
Adorna M. Perrin, B.A.; *sales clerk*
Barbara B. Robinson, B.A.; *assistant manager*
Levertia Short, *sales clerk*
Andre Charles Smith, *sales clerk*
Robert J. Stack, *sales clerk*
Louise Waters, *sales clerk*
Michael B. Wilder, *sales clerk*
Elsie Willoughby, *sales clerk*
Alexandra D. Wilson, *sales clerk*

Special Events and Food Services

Gale Asikin, *vending room operator*
Michael A. Croon, B.A.; *special events*
Elise Guy, *food services assistant*
James Kern, M.A.; *auxiliary food services operator*
Susan M. Olson, *special events*
Linda R. Peterson, *special events*
Susan L. Potter, *secretary*
Andre Williams, *food services aid*

Public Relations

Sherry L. DeVries, B.A.; *manager*
Lisa G. Elkuss, B.S.; *associate*
Suzanne M. Santos, M.B.A.; *information coordinator*
Barbara J. Scott, B.A.; *assistant*
David M. Walsten, B.S.; *Bulletin editor*

General Services

Gustav A. Noren, *director*
Robyn R. Riley, *secretary*

Security and Visitor Services

Hugh P. Hamill, *manager*
Nancy Adams, *admissions cashier*
Clifford Augustus, *security officer*
Larry J. Banaszak, *senior security officer*
Helena Brown Banks, *temporary security supervisor*
Arnold C. Barnes Jr. *security officer*
Andrew J. Bluntson, *security officer*
Craig Bolton, *security officer*
Willie J. Brumage, *console operator*
Gabriel M. Brisard, *assistant supervisor*
Glanver A. Brooks, *security officer*
Pamela T. Buczkowske, *equipment assistant*
Marcia Carr, B.S.; *equipment manager*
Robert J. Cazy, *security officer*
Chantal L. Charles, *admissions cashier*
Chirkina I. Chirkina, *senior security officer*
Melvin C. Cosey, *senior security officer*
Katie Davis, *admissions cashier*
Josef M. Duanah, *security officer*
Lionel O. Dunn, *senior security officer*
Herman Ellis, *security officer*
Leatrice C. Evans, *lunchroom attendant*
Rodolfo Flores, *security officer*
Donald E. French, *security officer*
Robert G. French, *security officer*
Wayne R. Gerdes, B.S.; *security officer*
Teresa A. Glover, *admissions cashier*
Jesse Gomez, *senior security officer*
Rudolph Gomez, *security supervisor*
Steven A. Grissom, *senior security officer*
Richard D. Groh, A.A.; *security officer*
Tina I. Gulley, *secretary*
James N. Hammond, *admissions cashier*
Norman Hammond, *security officer*
Denise Hatter, *admissions cashier*
Geraldine Havranek, *telephone console*
Charles H. James, *security officer*
Charles M. Johnson, *senior security officer*
Dale R. Johnson, B.A.; *security supervisor*
Mirielle M. Laforest, *security officer*
Howard Langford Jr., *senior security officer*
Richard H. Leigh, *senior security supervisor*
LaShugn J. Lloyd, *security officer*
Charles Lozano, *senior security officer*
Floyd L. Lucas, *security officer*
Kathleen O. McCollum, B.A.; *senior security supervisor*
Derek McGlorthan, *senior security officer*
Carolyn M. Moon, *security officer*
Cozzetta Morris, *senior security officer*
Karlyn Morris, *senior security officer*
Michael R. Nash, *security officer*
Donna F. Nixon, *lunchroom attendant*
Robert F. Page, B.S.; *security officer*
Josie Poole, *security officer*
Jose Preciado, *security officer*
Rosemarie Rhyne, *senior security officer*
Freddie James Rice, *security officer*
Derek A. Richmond, *security officer*
Normal Robinson, *security officer*
Paris S. Ross, *security officer*
Emanuel Russell Jr., *assistant supervisor*
Bart H. Ryckbosch, B.A.; *security officer*
Irma Sanchez, *admissions cashier*
David F. Smith, *security officer*
Norris J. Smith, *security officer*
Edmund L. Steward, *security officer*
Debra A.Turnbull, *security officer*
Joe W. Vallejo, *security officer*
Julio Villasenor, *security officer*
Will Washington, *security officer*

Archives

Mary Ann Johnson, *archivist*
Pamela Sims, *assistant*

Mailroom

Lorraine H. Hobe, *supervisor*
Frantz Eliacin, *assistant*
Kevin D. Jones, *messenger*

Printshop

George C. Sebela, *supervisor*
Edward D. Czerwin, *printer*
Pamela Stearns, B.A.; *printing production coordinator*

Facility Planning and Operations

Norman P. Radtke, *manager*
Sharon Cook, B.A.; *secretary*
Andris Pavasars, M.S.; *assistant*
David Shultz, B.S.; *project engineer*
Gerald J. Struck, B.S.; *project engineer*

Engineering

Rudolph Dentino, *chief*
Robert J. Battaglia, *assistant chief*
Floyd D. Bluntson, *assistant engineer*
Earl W. Duncan, *stationary engineer*
Manual Gomez, *assistant engineer*
Michael J. Kowalczyk, *engineer assistant*
Terrence A. Marshall, *assistant engineer*
Thomas M. Moon, *maintenance electrician*
Joseph A. Nejasnic, *stationary engineer*
Edward John Penciak, *stationary engineer*
Harry Rayborn Jr. *stationary engineer*
Edward D. Rick, *electrician*
Larry Thompson, *assistant engineer*
Timothy Tryba, *stationary engineer*

Audiovisual

Ronald R. Hall, *manager*
Rayfield H. Drake, *tech.*
Julio Martinez, *ass't. tech.*

Maintenance

Jacques L. Pulizzi, *supervisor*
Dales S. Akin, *carpenter*
Luis G. Fernandez, *painter*
Daniel J. Geary, *craftsman*
Stanley B. Konopka, *carpenter*
George C. Petrick, *carpenter*
Librado Salazar, *painter*
George Schneider Jr., *painter*
Ernst P. Toussaint, *craftsman*
Henry Tucker Jr., *painter*
Robert D. Vinson, *craftsman*

FIELD MUSEUM STAFF

Housekeeping

Groundskeeper:
Guadalupe A. Medina

Housekeepers:
Ramon Alba
Rodolfo Amarillas
Harold A. Anderson
James A. Atkinson
George L. Berry
John D. Dameron
Cleola Davis
Marcolina Diaz
Liberio Gallegos
Jose S. Galvan
Claudia Gracia
Theodore J. Green
Kwan-Soo Han, B.S.
Robert L. Harris
Linn H. Jackson
Dewayne Jamison
LaVida R. Johnson
Gerard Kernizan
Kettly Lanarre
Lionell Martin
Jose Mendez
Seedel Montgomery
Ermite Nazaire
Lucinda Pierre-Louis
George W. Robinson
Ralph Rogers
Morgan Rucker
Rosa M. Salazar-Boone
Georgia Stanley
Leroy P. Thomas
Anthony D. Valentino
Dieudaide M. Victor

Personnel

Charsetta M. Henderson, M.B.A.; *manager*
Sandra D. Agharese, *secretary*
Paul E. Josenhans, *safety coordinator*
Helen A. Malina, B.A.; *benefits coordinator*
Marilyn C. Nelson, B.A.; *employment coordinator*
Carol D. Peters, B.A.; *employment coordinator*
Nadine M. Phillips, *clerk*

PUBLIC PROGRAMS

Michael Spock, B.A.; *vice president*
Deborah Cooke, *assistant to the vice president*
Janet C. McKinney, A.A.; *secretary*

Design and Production

Janet A. Kamien, M.Ed.; *chairman*
Jameil J. Al-Oboudi, *exhibit preparator*
Howard J. Bezin, B.F.A.; *exhibit preparator*
Tamara K. Biggs, B.A.; *exhibit preparator*
Daniel A. Brinkmeier, *exhibit preparator*
Mary A. Brogger, B.F.A.; *exhibit preparator*
John K. Cannon, M.F.A.; *production manager*
Brian L. Cavanaugh, B.F.A.; *exhibit preparator*
George S. Chavez, *exhibit preparator*
Edward Correll, M.F.A.; *exhibit preparator*
Peter J. Crabbe, M.F.A.; *exhibit preparator*
Lawrence L. Degand, *exhibit preparator*
Michael M. Delfini, B.A.; *graphic designer*
Randale C. Esslinger, *exhibit preparator*
Robin L. Faulkner, B.F.A.; *exhibit preparator*
Eric J. Frazer, B.F.A.; *exhibit preparator*
Pamela J. Gaible, M.F.A.; *exhibit preparator*
Terry M. Gibson, M.A.; *exhibit preparator*
Patricia A. Guizzetti, M.F.A.; *exhibit preparator*
Dianne Hanau-Strain, B.A.; *exhibit designer*
Nancy A. Henriksson, B.A.; *exhibit preparator*
Lynn B. Hobbs, B.F.A.; *graphic design supervisor*
Jeff E. Hoke, B.F.A.; *exhibit designer*
Walter A. Horak, *electrician*
Mary Jo Huck, B.F.A.; *exhibit preparator*
Douglas Jewell, B.F.A.; *exhibit preparator*
Rebecca S. Joworski, B.F.A.; *ass't graphic designer*
Neil J. Keliher, B.S.; *exhibit preparator*
James T. Komar, B.F.A.; *exhibit preparator*
Kathryn S. Lehar, M.F.A.; *exhibit preparator*
Raymond J. Leo, *exhibit preparator*
Lisa A. McKernin, B.A.; *exhibit designer*
Paul J. Martin, *senior exhibit designer*
Scott G. Mattera, B.F.A.; *exhibit preparator*
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Mary Maxon, B.S.; *exhibit preparator*
Dion E. Miller, *exhibit preparator*
George P. Monley, B.A.; *exhibit preparator*
Jessica A. Newman, *secretary*
Randolph Olive, A.A.; *exhibit preparator*
Gregory A. Olson, M.F.A.; *exhibit preparator*
Michael E. Paha, B.F.A.; *exhibit preparator*
Eric R. Pfeiffer, *exhibit preparator*
Susan I. Phillips, M.F.A.; *exhibit preparator*
David T. Potter, B.F.A.; *exhibit preparator*
Mykl F. Ruffino,B.F.A.; *exhibit preparator*
John Russick, B.A.; *exhibit preparator*
Brian Sauve, B.F.A.; *exhibit preparator*
Bruce A. Scherting, M.F.A.; *exhibit preparator*
Beverly C. Scott, B.S.C.; *secretary*
Joseph D. Searcy, *exhibit preparator*
James Vincent Shine, M.F.A.; *exhibit preparator*
Michael J. Shouba, B.A.; *exhibit preparator*
Manuel N. Silva, *exhibit preparator*
Donald R. Skinner, M.F.A.; *master designer*
William E. Skodje, M.F.A.; *exhibit preparator*
Rodney R. Stockment, *exhibit preparator*
John F. Voris, *exhibit preparator*
Daniel L. Weinstock, B.F.A.; *projects manager*
Robin L. Whatley, B.F.A.; *exhibit preparator*
Gregory Williams *exhibit preparator*
Jeffrey T. Wrona, M.F.A.; *exhibit preparator*
Mary E. Zebell, B.A.; *exhibit preparator*
Cameron A. Zebrun, M.F.A.; *exhibit preparator*

Program Development

Michael Spock, B.A.; *chairman*
Susan M. Curran, B.S.; *exhibit developer*
Richard S. Faron, B.F.A.; *assistant developer*
Robert A. Feldman, Ph.D.; *researcher*
Calvin Gray, B.A.; *assistant developer*
Douglas Grew, B.A.; *research assistant*
Carol E. Hageman, B.S.; *administration ass't*
Kathryn Hill, B.A.; *program coordinator*
Karen L. Hutt, *project coordinator*
Robert J. Izor, B.S.; *researcher*
Janet Kamien, M. Ed.; *master developer*
Hillary A. Lewis, B.S.; *administrative ass't*
Wendy H. Lindauer, B.A.; *researcher*
John G. Paterson, M.F.A.; *assistant developer*
Phyllis G. Rabineau, M.A.; *senior developer*

Education

Carolyn P. Blackmon, B.S.; *chairman*
Susan D. Bennett, B.A.; *hall interpreter*
Mary Ann Bloom, M.S.; *coordinator exhibit progs.*
Alice Burkhardt, M.A.; *hall interpreter*
Joe P. Byrnes, B.A.; *hall interpreter*
Robert Cantu, A.A.; *resource coordinator*
Mara L. Cosillo-Johnson, *hall interpreter*
Philip K. Courington, B.A.; *coordinator hall interpreters*
Maria Teresa Duncan, *hall interpreter*
Geraldine P. Enck, B.S.; *hall interpreter*
Nancy L. Evans, M.A.; *subj. matter specialist*
Cynthia J. Gulley, *resource coordinator*
Philip C. Hanson, M.S.; *head, school/community services*
Suzanne E. Hoffman, *hall interpreter*
Ann Horvath, M.F.A.; *preparator*
Sheila L. Kincade, *secretary*
Cynthia Knudson, B.A.; *hall interpreter*
Susan A. Koziol, *secretary*
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Peter H. Laraba, B.S.; *subj. matter specialist*
Ellen Leeds-Zebrun, M.F.A.; *volunteers coordinator*
Lucille Lillard, *secretary*
Earl W. Lock, M.F.A.; *preparator*
Jo Ellen McKillop, B.A.; *loan processor*
Marcia Z. MacRae, B.A.; *hall interpreter*
Joyce E. Matuszewich, B.A.; *loans coordinator*
Ingrid P. Melief, M.A.; *resource center facilitator*
Patricia L. Messersmith, B.A.; *program developer*
Norann C. Miller, *secretary*
Julie A. Pitzen, B.A.; *hall interpreter*
Thomas J. Rath, *hall interpreter*
Katherine L. San Fratello, B.A.; *hall interpreter*
Maija L. Sedzielarz, B.A.; *coordinator teacher programs*
Sandra P. Snyder, B.A.; *hall interpreter*
Susan E. Stob, B.A.; *head, public progs. and services*
Susan M. Summerfield, B.A.; *hall interpreter*
Jessie Thymes, *coordinator community outreach*
Alexia J. Trzyna, B.F.A.; *coordinator staff & volunt. training*
Judith D. Vismara, B.A.; *coordinator adult & family programs*
John A. Wagner, Ph.D.; *subj. matter specialist*
James M. Watson, B.S.; *hall interpreter*

RESEARCH ASSOCIATES, ASSOCIATES, FIELD ASSOCIATES

DEPARTMENT of ANTHROPOLOGY

Research Associates

Dean E. Arnold, Ph.D.;
Yucatan ethnoarchaeology
Eloise Richards Barter, M.A.;
American Indian ethnography
Robert J. Braidwood, Ph.D.;
Old World prehistory
William J. Conklin, M.A.;
Peruvian architecture and textiles
Philip J. C. Dark, Ph.D.;
African ethnology
Richard D. DePuma, Ph.D.;
Etruscan archaeology
Fred R. Eggan, Ph.D.;
ethnology
Patricia S. Essenpreis, Ph.D.;
North American archaeology
Robert Feldman, Ph.D.;
South American archaeology
Gray Graffam, M.A.;
Andean archaeology
Ho Chuimei, Ph.D.;
Asian archaeology
Bill Holm, M.F.A.;
North American native art
F. Clark Howell, Ph.D.;
Old World prehistory
Maxine R. Kleindienst, Ph.D.;
Old World prehistory
Alan L. Kolata, Ph.D.;
South American archaeology and ethnography
Lyle Konigsberg, Ph.D.;
physical anthropology
W. Frederick Lange, Ph.D.;
Meso American archaeology
Donald W. Lathrap, Ph.D.;
South American archaeology
Charles E. Lincoln, M.A.;
Mayan studies
Michael A. Malpass, Ph.D.;
Andean archaeology
Michael E. Moseley, Ph.D.;
South American archaeology
Charles R. Ortloff, M.Ae.E.;
Peruvian archaeology
Robert B. Pickering, Ph.D.; *human osteology and archaeology*
Jeffrey Quilter, Ph.D.;
South American archaeology
George I. Quimby, A.M.;
North American archaeology and ethnography
David Reese, Ph.D.;
archaezoology and paleomalacology
Johan G. Reinhard, Ph.D.;
Nepal, Bolivia, and Peru
Donald S. Rice, Ph.D.;
Latin American prehistory and ethnohistory
Prudence E. MacDermod Rice, Ph.D.;
Meso American archaeology
Amy Oakland Rodman, Ph.D.;
textiles
William Rostoker, Ph.D.;
metallurgy
Robin Torrence, Ph.D.;
Melanesia
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Amazon Basin, Northwest Coast archaeology and ethnology
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North American ethnology
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Oceanic material cultures

DEPARTMENT of BOTANY

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ethnobotany
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vascular plants
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vascular plants and mycology
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Ursula Rowlatt, D.M.;
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Rolf Singer, Ph.D.;
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vascular plants

Associates

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fossil vertebrates
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fossil vertebrates
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fossil vertebrates
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fossil invertebrates
Robert Clayton, Ph.D.;
geochemistry
Albert Dahlberg, D.D.S.;
fossil vertebrates
Andrew Davis, Ph.D.;
geochemistry
Robert DeMar, Ph.D.;
fossil vertebrates
Daniel Fisher, Ph.D.;
fossil invertebrates
Gary J. Galbreath, Ph.D.;
fossil vertebrates
Lawrence Grossman, Ph.D.;
meteoritics
Antoni Hoffman, Ph.D.;
fossil invertebrates
James A. Hopson, Ph.D.;
fossil vertebrates
David Jablonski, Ph.D.;
fossil invertebrates
Michael Labarbera, Ph.D.;
fossil invertebrates
Riccardo Levi-Setti, Ph.D.;
fossil invertebrates
Kubet Luchterhand, Ph.D.;
fossil vertebrates
Ernest L. Lundelius, Jr., Ph.D.;
fossil vertebrates
Frank K. Mckinney, Ph.D.;
fossil invertebrates
Everett C. Olson, Ph.D.;
fossil vertebrates
David M. Raup, Ph.D.;
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fossil invertebrates
Paul Sipiera, Ph.D.;
meteorites
Joseph V. Smith, Ph.D.;
mineralogy
Leigh Van Valen, Ph.D.;
fossil vertebrates

Field Associate

Thomas E. Guensburg, Ph.D.;
fossil vertebrates

DEPARTMENT of ZOOLOGY

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birds
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insects
William J. Beecher, Ph.D.;
birds
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insects
Joel Cracraft, Ph.D.;
birds
Gustavo A. Cruz, M.Sc.;
fishes
Sharon Emerson, Ph.D.;
amphibians and reptiles
Jack Fooden, Ph.D.;
mammals
Elizabeth-Louise Girardi, Ph.D.;
invertebrates
David Greenfield, Ph.D.;
fishes
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amphibians and reptiles
Lawrence R. Heaney, Ph.D.;
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Myriam Ibarra-Stewart, Ph.D.;
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birds
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mammals
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birds
W. Wayne Moss, Ph.D.;
insects
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mammals
Roy Norton, Ph.D.;
insects
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mammals
Ronald Pine, Ph.D.;
mammals
George Rabb, Ph.D.;
amphibians and reptiles
Charles Reed, Ph.D.;
mammals
H. Bradley Shaffer, Ph.D.;
amphibians and reptiles
Ronald Singer, Ph.D.;
mammals
Donald Stewart, Ph.D.;
fishes
Margaret Thayer, Ph.D.;
insects
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amphibians and reptiles

Field Associates

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invertebrates
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amphibians and reptiles
Barbara Clauson, M.S.;
birds and mammals
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zoology
Teresa Arambula Greenfield, M.A.;
fishes

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Manuel A. Plenge,
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Laurie Price,
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birds
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insects
Lorain Stephens Olsen,
birds
Ray Pawley,
amphibians and reptiles

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Patinya Ambuel
Dolores Arbanas
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Ian Ausubel
Margaret Axelrod
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Paul Baker
Jean Baldwin-Herbert
Barbara Ballard
Dennis Bara
Lucia Barba
Nancy Barco
Dr. George Barnett
Gwen Barnett
Dodie Baumgarten
Barbara Beardsley
Virginia Beatty
Jeanne Bedrosian
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Susan Bennett
Carol Benzing
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Robert Berns
Ruth Berns
Elaine Bernstein
Frieda Bernstein
Jennifer Blitz
Fran Braverman
Carol Briscoe
Carolyn Brna
Irene Broede
Garland Brown
Robert Brunner
Sophie Ann Brunner
Brenda Buckley-Kuhn
James Burd
Joseph Cablk
Rick Capitulo
Kitty Carson
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Roosevelt Road at Lake Shore Drive
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FIELD MUSEUM

THE SMART WAY TO HAVE FUN.

FIELD MUSEUM OF NATURAL HISTORY BULLETIN

September / October 1989

Field Museum of Natural History Bulletin

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Sports Feelings

Sept. 14 - Nov. 26

This major exhibition of American and Soviet sports photography speaks to the universality and humanity of sport. The first joint exhibition of its kind, "Sports Feelings," features more than 100 action photographs taken by photographers from *Sports Illustrated* magazine and by photographers of the Soviet Union. The exhibition toured five cities in the Soviet Union before beginning its United States tour in 1988.

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COVER

Charles Carpenter: Native American Portraits

Through March 17, 1990

Geronimo, famed Apache Indian chief, as recorded through the camera lens of Charles Henry Carpenter in 1904. The photo session took place at the Louisiana Purchase Exposition in St. Louis, at which time Carpenter (1859-1949) was Field Museum's chief photographer, a post he held from 1899 until 1947. This photo is among 35 portraits by Carpenter that will be on view through March 17 in the Webber Resource Center for Native Cultures of the Americas. The center's hours (slightly shorter than regular Museum hours) are noon to 5:00pm on weekdays and 10:00am to 5pm on weekends. The exhibit was funded by the Union League Club of Chicago's Civic and Arts Foundation.
Neg. 15793

SEPTEMBER/OCTOBER

Attention Members and Subscribers

This issue of the *Bulletin* is for the period of September and October. All subscriptions will be extended by one month beyond the anticipated termination date.

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EVENTS

Featured Lectures

VANISHING RAIN FORESTS: THE EARTH IN CRISIS

Tropical biodiversity is staggering—about 60% of all plant and animal species live in tropical rain forests. Even more staggering: much of this diversity will never be known for its medicinal, agricultural, or industrial uses or its role in natural ecosystems. In October and November Field Museum hosts several renowned scientists who provide insights into this worldwide dilemma through a series of 5 public lectures, each with a question-and-answer session.

☑ *Saturday, Oct. 21, 2:00pm*
"The Growing Threats to Tropical Biodiversity"
Norman Myers, Consultant in Environment and Development

☑ *Saturday, Oct. 28, 2:00pm*
"An Impending Extinction Crisis: Risk, Fantasy, or Accomplished Fact?"
Jared M. Diamond, Professor, Dept. of Physiology, School of Medicine, University of California, Los Angeles

☑ *Saturday, Nov. 4, 2:00pm*
"The Threat to the Living World"
Peter H. Raven, Director, Missouri Botanical Garden

☑ *Saturday, Nov. 11, 7:00pm*
"Population Growth and the Destruction of Tropical Forests"
Paul R. Ehrlich, Bing Professor of Population Studies, Dept. of Biological Sciences, Stanford University

☑ *Saturday, Nov. 18, 2:00pm*
"Biodiversity and the Tropical Forest"
Russell A. Mittermeier, President, Conservation International

Tickets Please use coupon on P.4.

Series $20 ($12 members); single $5 ($3 members). Group rates available for groups of 12 or more.
Call (312) 322-8854 to register or for information.

Workshops for Educators

Classroom teachers, scout leaders, naturalists, and other educators of all age levels are invited to participate in a series of 3 workshops offered in conjunction with this lecture series. A limited number of series tickets is available at no charge to educators on a first-come, first-serve basis. Call (312) 322-8854 for further information.

Family Lecture

Flap, Flutter, and Fly
An Introduction to Family Bird Watching

Sunday, Oct. 22, 2:00pm
Neil Dawe, Habitat Manager, Canadian Wildlife Service and Karen Dawe, Naturalist and Author

How does a nuthatch crack nuts? Who does the mockingbird mock? Why do birds take "ant baths"? Answer these questions and more as you learn about bird identification and bird behavior. In a program especially for families with kids ages 5-12, learn to observe, identify, and care for those creatures who flap, flutter, and fly. Play bird games and (weather permitting) take a bird walk along the lakefront.

Tickets

$4 adults; $2 children 12 and under. LL89307 "Flap, Flutter and Fly"—Child; LL89308 "Flap, Flutter and Fly"—Adult.

Please use coupon on P.4.

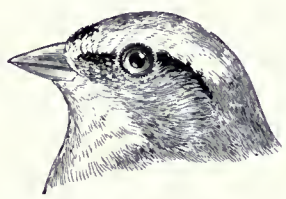
Adult Programs

— Field Trips —

One-day weekend field trips for adults continue through October. Explore the dramatic geology of the Starved Rock Area, see the fascinating contrasts of Lake County, Illinois, experience the nocturnal woods in a night hike, or enjoy a fall color walk in the Palos Park region. Check the September/October Adult, Children, and Family Program Brochure for further information or call (312) 322-8854.

—Weekend Workshops—

Trace the development of Paleolithic cultures, learn the traditions and functions of miniature Japanese *netsuke* sculptures, or examine mask-making techniques while making an Egyptian mummy mask of your own face. An exciting range of adult weekend programs begin in October. See the September/October Adult, Children, and Family Program brochure for details or call (312) 322-8854.



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EVENTS

World Music Programs

Weekends in September and October
1:00pm and 3:00pm

Program Highlights include:

☐ *Sept. 2, 3*
1:00pm—Douglas Ewart plays Japanese and Australian flutes
3:00pm—Librado Salazar plays classical guitar

☐ *Sept. 9, 10*
1:00pm—Thunder Sky Drummers play African percussion
3:00pm—Raices del Ande performs Latin American folkloric music

☐ *Sept. 16, 17*
1:00pm—Amira demonstrates the African shakere
3:00pm—Chicago Beau plays blues harmonica

☐ *Sept. 23, 24*
1:00pm—Shanta tells African stories and sings African songs
3:00pm—Darlene Blackburn demonstrates African dance.

☐ *Sept. 30, Oct. 1*
1:00pm—Chinese Music Society of North America demonstrates instruments from the Chinese orchestra
3:00pm—Eli Hoenai presents African instruments

☐ *Oct. 7, 8*
1:00pm—Light Henry Huff plays contemporary jazz harp
3:00pm—Fan Wei-Tsi demonstrates the Chinese zither

☐ *Oct. 14, 15*
1:00pm—Shanta tells African stories and plays African instruments
3:00pm—Librado Salazar plays classical guitar

☐ *Oct. 21, 22*
1:00pm—Chinese Music Society of North America demonstrates instruments from the Chinese orchestra
3:00pm—Darlene Blackburn demonstrates African dance

☐ *Oct. 28, 29*
1:00pm—Douglas Ewart plays Japanese and Australian flutes
3:00pm—Chicago Beau plays blues harmonica.

The World Music Program is supported by the Kenneth and Harle Montgomery Fund and a CityArts grant from the Chicago Office of Fine Arts, Department of Cultural Affairs, and the Illinois Arts Council, a state agency. These programs are free with Museum admission and tickets are not required.

Weekend Programs

EACH SATURDAY AND SUNDAY you are invited to explore the world of natural history at Field Museum. Free tours, demonstrations, and films related to Museum exhibits are designed for families and adults. The activities below are some of many offered each weekend. Check the activity listing upon arrival for a complete schedule, and locations. The programs are partially supported by an Illinois Art Council grant.

September
9,23 12:30pm *"Museum Safari"* takes you through the four corners of the Museum to see the seven continents. See antiquities from the Amazon, big game from Africa and seals from the Arctic.

October
7,21 12:30 pm *Museum Safari*
14 1:30 pm *Tibet Today and A Faith In Exile* focuses upon Tibetan refugees in India, Dharmsala, Darjeeling, and Sikkim, and includes slides of a Himalayan Buddhist temple ceremony.

Registration

Be sure to complete all requested information on this registration application. Registrations are confirmed by mail. For registrations received less than two weeks before the program date, confirmations are held at the West Door for pick-up one hour before the program begins. Phone registrations are accepted using Visa/MasterCard/AMX/Discover. Please call (312) 322-8854 to register. The minimum amount for credit cards is $15.00. For further registration information, consult the September/October Adult, Children, and Family Program Brochure.

Return complete registration with a self-addressed stamped envelope to:

Field Museum of Natural History
Department of Education, Program Registration
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605-2497

Lecture Number	Date	#Children	#Members	#Non-Members	An
"Vanishing Rain Forests" Entire Series	Oct. 21-Nov. 18-2:00 p.m. Nov. 11-7:00 p.m.				
"Vanishing Rain Forests" Single Lecture	Indicate Date(s)				
"Vanishing Rain Forests" Single Lecture	Indicate Date(s)				
LL89306 "Flap, Flutter & Fly" (Child)	October 22-2:00 p.m.				
LL89307 "Flap, Flutter & Fly" (Adult)	October 22-2:00 p.m.				
				Total	

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FIELD BRIEFS

Jonathan Haas Named Vice President For Collections and Research

Jonathan Haas

Dr. Jonathan Haas, director of Programs and Research at the School of American Research, Santa Fe, New Mexico, has been chosen vice president for Collections and Research. He succeeds Dr. Harold Voris, who has served in that position for five years.

A native of New Mexico, Dr. Haas received his B.A. from the University of Arizona and his M.A., M. Phil., and Ph.D. with distinction in anthropology from Columbia University. Before going to the School of American Research, he served as a member of the faculty at the University of Denver.

He has been an active archaeologist, working extensively in the Southwest, and is the author or editor of several books and monographs, including: *The Origin and Development of the Andean State*, co-editor, 1987; *The Evolution of the Pre-Historic State*, 1982; *The Curation and Management of Archaeological Collections: A Pilot Study*, with Alexander J. Lindsay and Glenna Williams-Dean, 1980. Forthcoming are two publications: *The Anthropology of War* and *The Kayenta Warfare Project.*

Dr. Haas will join the Field Museum also as curator of Anthropology. His spouse, Winifred, is an active anthropologist and will be a research associate in the Department of Anthropology.

Dr. Voris, whom he succeeds, will be resuming full-time research and curatorial activities in herpetology.

Lee Webber Recognized

E. Leland Webber

The Honors Committee of the American Association of Museums has recently selected trustee E. Leland Webber as the 1989 recipient of the Award for Distinguished Service to Museums. Webber retired from the post of Field Museum president in 1981; he had been the Museum's chief executive officer since 1962 and had served on the staff for more than 31 years.

The award was established to recognize unusual excellence and distinguished contributions to the museum profession. It is the association's highest honor given to a person who has made a cumulative contribution to the field of museums. Lee Webber joins a list of the country's most outstanding museum leaders. The award recognizes Webber's leadership of the Field Museum and the Chicago museum community. It also honors his significant involvement in the legislative arena both at the state and federal levels.

Willard Boyd Honored by NEH

The National Endowment for the Humanities has selected Field Museum president Willard L. Boyd to receive one of its first Charles Frankel Prizes, citing his efforts to "expand the educational potential and cultural diversity of the nation's museum programs."

Sandy Boyd has played a major role in making cultural institutions more accessible to the public, observes Lynne Cheney, National Endowment for the Humanities chairman. "(Museums) see themselves as schools, and Sandy Boyd has been a real leader in bringing this transformation about."

"Anymore it's not just 'Let's hang the pictures on the walls and put the artifacts in the cases,'" Cheney said.

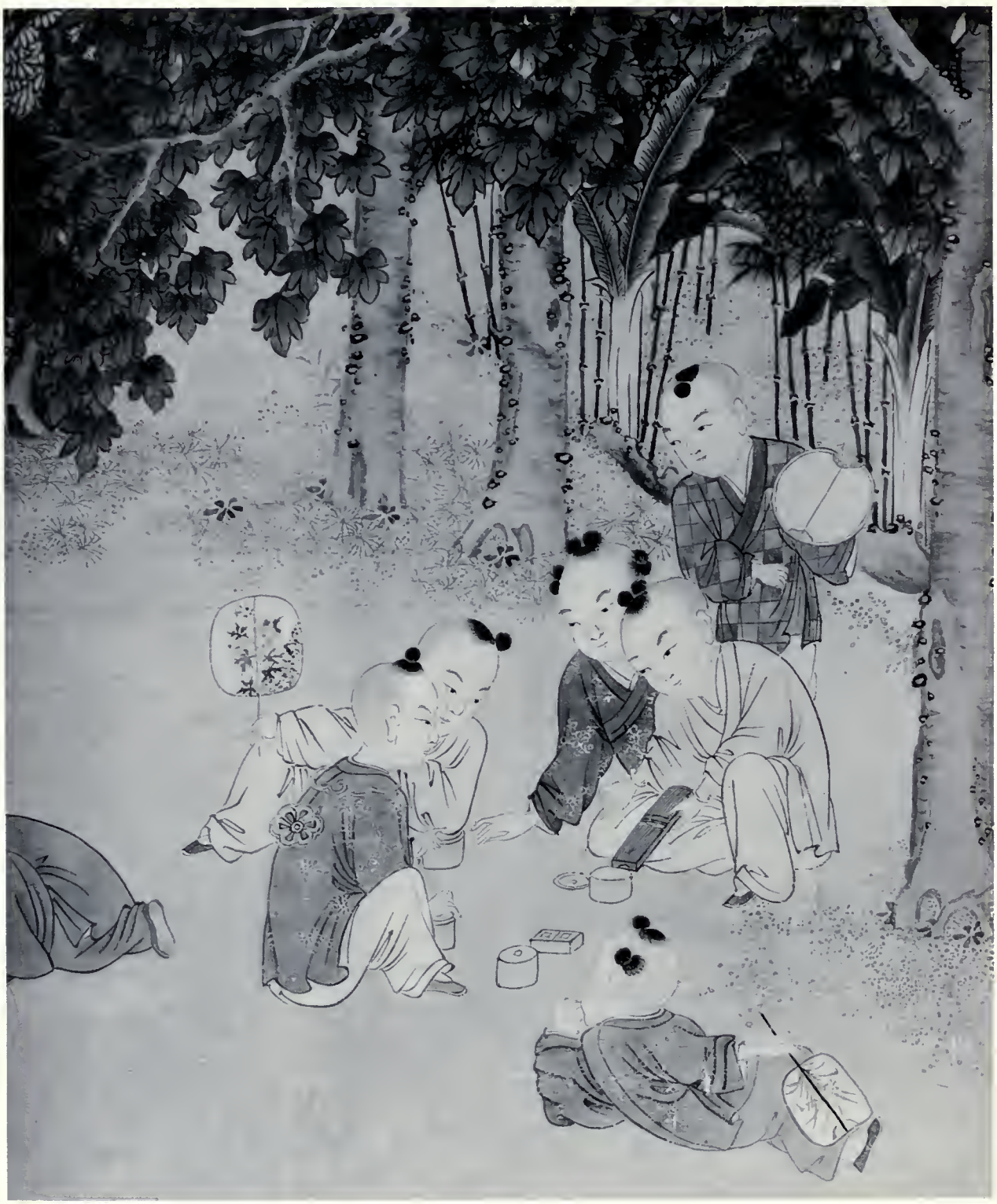
Boyd was one of five winners of the prize, a $5,000 award named for the late Charles Frankel, first president and director of the National Humanities Center. Formal presentation will be made in November.

"I view this as really an award to the Field Museum," said Sandy upon learning of the honor. "People here are making the Museum a place that is more accessible to the discussion of humanistic issues." He is presenting his $5,000 award to the Museum to be used for a new exhibit on Africa.

Willard L. Boyd

Ceramic Cricket Jars in the Field Museum

by Ho Chuimei, Lisa Adler and Bennet Bronson
photographs by Wang Wang-fai



Painted hand scroll on silk, titled "Pictures of 100 Children," with detail showing boys playing with crickets. The scroll probably dates to the 18th or 19th centuries but bears the signature of Su Hanchen, a painter of the 12th century who was noted for his paintings of children at play. The style is not that of a genuine 12th-century work. 33724.

1. CRICKET-KEEPING UTENSILS, early 20th century (l. to r.). Tin cricket box *with double base for cold weather. The 2 glass panels on the side serve as windows for a pair of compartments separated by a vertical plate. The hinged lid has openwork top; cat. 126384.* Bamboo bar cage *with vertical sliding grill on one side and glass top. Such cages can be used for almost any type of insect. This cage was sold as a grasshopper cage. Acquired in Hangzhou; cat. 126408.* Brass cricket jar, *cylindrical with sloping clay floor. The lid top has openwork repoussé decorated with magpies and plum blossoms, signifying happiness in spring. Made in Beijing. Diam. 5 cm; cat. 133189.* Ivory bar trap. *The sliding door can be shut with a finger after a wild cricket is lured inside. The door is topped by carving of a mouse eating fruit. Acquired in Beijing; cat. 235014.*

Cricket Keeping

The custom in China and Japan of keeping crickets for the music they produce is easy for us to understand; for we, too, enjoy the sound those insects make on summer evenings; but some readers may be surprised to learn that the Chinese also keep crickets for fighting. Although farm boys in many places know that male crickets will fight when placed together in small containers, only in China is cricket fighting a common sport. Even today, in various parts of that country, cricket fights are held and money bet on the outcome. Local officials may frown on this activity and relatives may object, but crickets that are good singers or fighters continue to be sold for high prices. Cricket fanciers take time off from work to attend fights or swap sessions, and come together to compare techniques of catching, raising, feeding, and caring for their pets.

The husbandry of singing crickets goes back to at least the seventh century in China, but cricket fighting is more recent. The earliest known handbook on raising and training fighting crickets was written in the thirteenth century by Jia Sidao, a general of the Southern Song Dynasty (A.D. 1127-1278) who is otherwise famous for having neglected his military duties to the extent that the Mongols were able to conquer China. Even in Jia's day, cricket fanciers were using special equipment to capture and maintain their pets. They also had an elaborate technical nomenclature. Modern cricket manuals list dozens of names for variations in color and form within single cricket species: "star-headed," "jade hoe," "glossy lantern," "iron bullet," and the like. The manuals also contain detailed instructions about diets and medications for fighting crickets at various stages of their brief lives.

The leading Western authority on Chinese cricket-keeping was Berthold Laufer, a Field Museum curator from 1908 to 1934. His "Insect Musicians and Cricket champions" (1927), though little known to the general public, remains the standard non-Chinese work on the subject. It has been often quoted by

Authors: Ho Chuimei is a research associate in Anthropology, Lisa Adler is a volunteer, and Bennet Bronson is curator of Asian archaeology and ethnology and chairman of the Department of Anthropology. Photographer Wong Wang-fai is also a volunteer.

Chinese authors and—perhaps an even higher compliment—was plagiarized extensively a few years ago by a writer for a leading art magazine. The only other western work of equal stature on Asian cricket-keeping is the marvelous essay "Insect Musicians," on singing crickets in Japan, by Lafcadio Hearn (1850-1904). Laufer's somewhat Germanic prose is not the equal of Hearn's for stylistic beauty, but the breadth and scope of his information is unsurpassed. It is our aim in this essay merely to supplement Laufer's work, providing data that was not available to him and correcting him on some minor details. Interested readers will want to consult the Laufer article for a broader view of the subject (see Suggested Reading, p. 15). A variety of items used in the raising and maintaining of crickets, largely collected by Laufer, are to be seen in Case 4, in the China Hall, on the Museum's second floor.

Fighting Crickets

The Chinese keep and sometimes breed many kinds of crickets for purely musical purposes. Hsu Yin-ch'i, one of the few entomologists with an interest in the cultural as well as the zoological aspects of the cricket, identifies three species kept for singing in northern China and at least eight in eastern China. The Japanese, too, keep a number of species of musical crickets, the most noted of which, *Homeogryllus japonicus*, the sweet-singing "Golden Bell," is also favored by the Chinese.

Those species kept for fighting are fewer than the singers, but authorities disagree on the exact number. Hsu names four: *Grylloides berthellus* and (sometimes) *Gryllus mitratus* from northern and eastern China, plus *Gryllus chinensis* and *Liogryllus bimaculatus* from southern China. The latter two, Hsu notes, are much larger than the former. Guo and his associates, on the other hand, regard *berthellus* and *chinensis* as varieties of the same species, *Scapsipedus aspersus*, which ranges from China's subtropical south to the frigid north. Laufer and most subsequent authors appear uncertain about the exact identification of the main kinds of fighting crickets. Recent cricket books usually include long lists of traditional names in one chapter and much shorter lists of scientific names in another, with no attempt to reconcile the two.

With the help of Field Museum entomologists, we hope eventually to resolve this confusion. For the moment, however, we must be content with the following observations: (1) at least several species are used for fighting; (2) the majority of fighters belong to either one highly variable species or to two closely related species; and (3) fighting crickets from different environments within China are likely to have quite different habits and life histories. The greatest environmental difference is that between the cold, dry North and East on the one hand and the warm, humid South on the other. As we shall see, that difference is reflected in traditions of cricket keeping.

In all parts of China, cricket fanciers seem to prefer wild to captive-bred insects for fighting purposes. In

2. Cricket Ticklers, Feeding Dishes, and Plaques, early 20th century. Top: *straw ticklers with bamboo tube container and cap, Shanghai; cat. 126402.* Center: *Tickler with ivory handle and rat whiskers, Beijing; cat. 127849B.* Bottom: *3 feeding dishes of blue and white porcelain, made in Jingdezhen?; cat. 126385A, B, C.* Right: *ivory plaques in shape of double gourd. Name of champion fighting cricket is inscribed on plaque, which is given to cricket owner; 6 cm long; cat. 127831.*

the North these are captured in the early autumn and in the South just before the rainy season. With allowance for a few weeks of special feeding and conditioning, this means that the northern fighting season is in October and November, and the southern season in June and July. In the colder climates, wild crickets have laid their eggs and died by late fall, but fanciers manage to keep some of their pets alive—mostly for singing rather than fighting—until well into the winter.

Where to find the best fighters is a well-guarded commercial secret, but legend often puts the best cricket-catching areas in graveyards or in remote mountains or other locations that are hard to get to. Rock-dwelling crickets are said to be fiercer than those that live in the grass, and diet—in the wild as well as in captivity—is thought to play an important role in determining a cricket's aggressiveness. Very high prices were and still are paid for the best fighters. John Henry Gray, a Canton resident during the 1870's noted that owners of successful crickets won not only large sums of money as bets but also trophies in the form of gilded, flower-like ornaments. Deceased champion crickets were buried in tiny silver coffins.

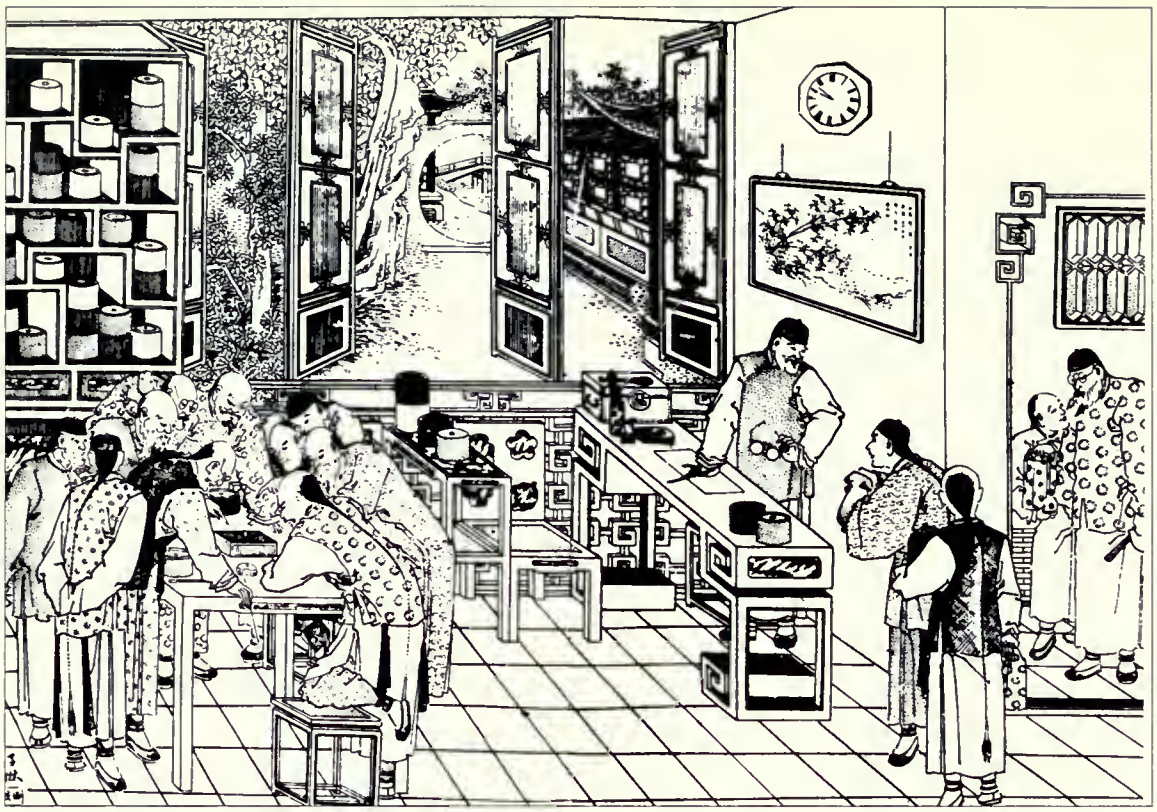
Male crickets are the fighters and the singers; females are kept only for breeding and, in the South at least, for raising the morale of the opposite sex. The males of many cricket species are naturally aggressive, chirping a special song, which establishes territory, and attacking other males when encounters occur. Those kept for fighting in northern and eastern China generally battle to the death, while those of the southern fighting species, although larger and more ferocious-looking, seem to calm down as soon as they have established clear dominance over their opponents. A cricket that has once been defeated is considered useless for further fighting, becoming submissive and reluctant to chirp. However, recent laboratory experiments in this country have shown that deafened crickets retain their aggressiveness even after losing several battles. We are not sure whether cricket fanciers in China are aware of this potentially valuable piece of information.

Cricket Utensils

In the opinion of the Chinese, one needs much more than a perforated tin can to properly care for crickets. The classic cricket literature recommends a wide range of special apparatus for catching, keeping, breeding, and transporting them. A representative list of basic equipment is given by Li Shisun, a leading recent authority on fighting crickets: jars used as cages, metal containers used in cold weather, traps, and so forth.

Thanks to Laufer, Field Museum has a large, well-documented collection of cricket equipment which includes most of the items in Li's inventory (fig. 1). The Museum also has several items not specified by Li, including ivory trophies, small porcelain water containers, and "ticklers" for encouraging reluctant crickets to fight (fig. 2). These utensils can be made of a wide variety of materials, ranging from wood and grass

3. CRICKET GOURDS *with ivory rims, late 19th-early 20th cent., Beijing (l. to r.).* Heat-engraved decorations: *A continuous landscape is burned into the surface with heated knife or needle. The scene has the 3-section format of many Chinese paintings—foreground with house and bridge, middle ground with boats, background with mountains. Lid is single piece of carved ivory; 11 cm. high; cat. 125968.* Molded decoration: *Raised design was formed by growing the gourd into four-piece mold. It depicts two boys playing with toy elephant on wheels, surrounded with symbols of wealth, good luck, and fertility. Details are highlighted by heat engraving. Lid has flat bone top with 7 circular holes for ventilation. 9.5 cm high; cat. 127712.* Carved decoration: *Four peonies around waist were carved in low relief, after which surface was stained and waxed to simulate original gourd skin. Lid top is of carved jade and horn. 20.5 cm high; cat. 127736.*



4. Cricket Club in Shanghai, shown in lithograph from early Chinese magazine. Man behind writing table is probably the club's organizer. From Dianshizhai Huabao, *Mou Section*, ca. *1885, Shanghai.*

to ivory and jade. All writers agree that while crickets seem to perform just as well if their accoutrements are cheap, their owners, like certain dog and cat lovers in our own society, are inclined toward ostentation.

The best known and most sought-after item of cricket equipment among Western collectors is the cricket gourd, which many moviegoers learned about in the recent film *The Last Emperor.* Such gourds, small and hourglass-shaped, were formerly carried on the persons of wealthy cricket fanciers. In the Manchu period these gourds were shaped by insertion into molds during growth to produce embossed designs on their surfaces; more recent gourds are decorated by carving or by burning with a hot iron. Several examples from Field Museum's collection are shown in figure 3. The designs on the gourds themselves and their richly decorated tops, often made of ivory or jade, help to account for the high prices paid for fine antique examples.

Cricket gourds may have been less popular among cricket fanciers than art collectors, however. Their use was more or less confined to the Beijing area and is rather recent, the earliest surviving example dating only to the time of the Kangxi Emperor (A.D. 1671-1722). Moreover, such gourds were considered suitable only for singing species; fighting crickets were kept in other types of containers.

We will focus here on a more widely used group of cricket containers: beds, jars, and fighting arenas made of unglazed, low-fired ceramic. Although of central importance to the practicing cricket keeper and of substantial interest to Chinese collectors, this type of container is virtually unknown to Westerners. As far as we know, the following text is the first extended treatment of that subject in any language other than Chinese.

Cricket Jars

Cricket fighting was (and apparently still is) organized by more or less informal clubs whose members gathered regularly at a special place during the fighting season. Figure 4, reproducing a lithograph from a magazine published in 1885, depicts a meeting of one such club in the Shanghai area. A number of well-dressed men are in an apparent clubhouse. Some have just arrived with their carefully bundled-up crickets in ceramic jars. Others are already deeply into the game, gathered around a square fighting court in the middle of the table. On the shelves are more cricket jars. Various other items of cricket equipment are also to be seen around the room.

5. Cylinorical Earthenware Cricket Jars with solid lids. Beijing and Suzhou, early 20th cent. **Left:** *The jar's black walls are plain, but lid has impressed designs on both sides—uniformed soldier on outside, dancing figure on inside. Inscription says the style is after that of Xinluo Shanren (i.e., the painter Hua Yan, A.D. 1682-1765). On the base is another impressed seal with two names: Li Xiufang, perhaps early maker of cricket jars mentioned by Zhu Yan, and Sun Ruishen, maker of this piece. Acquired in Suzhou; diam. 11.2; cat. 126389.* **Middle:** *Interior has black sand floor. Lid is molded with designs on both sides: on the top, a pagoda not unlike the White Pagoda in Beijing; on the bottom, five bats (happiness) surrounding the character* shou (longevity). *Acquired in Beijing; diam. 8 cm; cat. 127797.* **Right:** *Red jar in barrel shape. Lid and sides are decorated with impressed butterflies and flowers. Seal on base reads* Su Pan, *"Suzhou basin." Acquired in Beijing; diam. 7.5 cm; cat. 127809.*

It is the jars that interest us here. Similar jars are used for keeping crickets in the Beijing-Tianjin area during the late summer and early fall, after which the crickets are transferred to gourds. In the Shanghai-Suzhou area, in eastern China, crickets live in such jars throughout the fighting-singing season. Several sizes and shapes were formerly used: small cylindrical containers about the size of the gourds; medium-sized containers about 8 cm in diameter and 6 cm high; and large containers 11-12 cm in diameter and 9-10 cm high. The small ones generally have pierced lids for ventilation, the larger ones have loose-fitting solid lids. All are made of unglazed clay fired at low temperatures, for it is essential that the clay be porous in order to retain the moist atmosphere that crickets need (fig. 5).

All authorities agree that fighting crickets also need a somewhat irregular but soft surface underfoot; a hard smooth surface, like that of glazed pottery, will, they believe, damage the cricket's claws and make it less courageous. For this reason, modern cricket fanciers in Guangdong lay a sheet of coarse paper on the bottom of the cricket container, and both southerners and northerners often use layers of fine clay mixed with lime for the same purpose. Authorities also agree that one must be careful about using new jars. As Xiao Guang, an 18th-century writer on crickets, remarks: *"In early autumn one should use old and large jars for keeping crickets. . . .The new jars have too much 'fire,' being freshly baked. The weather being dry and hot, it is essential to keep the jar in a damp place. I would recommend using cold tea to soak the jar twice a day, and to change the [cricket's drinking] water thrice.*

"In mid-autumn it is better to use old jars and to change the water twice a day. In late autumn one should use new jars and place them in a draft-proof place. It does not matter then if you have to use smaller or polished jars."

Formerly well known for their cricket jars were Lumu, a village just outside Suzhou in Jiangsu Province, eastern China; and a Beijing suburb in northern China. Lumu made medium-sized and large jars of the kind preferred there, sometimes exporting these outside the province. The center near Beijing seems to have specialized in small jars about the same size as the local cricket gourds.

6. Communal Kiln at Lumu for firing cricket jars. The pipe at right is for blowing air into kiln. Photo: Ho C.M.

Lumu is locally famous for its dark gray bricks and tiles, but the village is by no means a great ceramic center. Its fame for clay cricket jars, however, was well established at least two centuries ago, probably because Lumu was so close to the cultured and influential city of Suzhou. Zhu Yan, a well-known 18th-century ceramic critic, recorded that cricket jars from Suzhou—most likely of Lumu origin—were highly esteemed. During a recent visit to the Suzhou area, we found that Lumu still produces traditional bricks and tiles as well as cricket jars. The former are made in a large state factory and the latter in the homes of the villagers who manufacture the jars in their spare time. Almost every family of Lumu is involved in this cottage industry, firing their products in small communal kilns (fig. 6). The shapes and even the seals of the early 20th century are still in use (fig. 7). The potters seem to do this without fraudulent intent, for they use early seals on all the jars they make and sell these to wholesalers for only 2 RMB (about 75¢) each. On the other hand, the ultimate retail price is quite high, ranging from 20 to 40 RMB per jar. It is not unlikely that purchasers sometimes believe they are buying valuable antiques.

While Lumu is popular for larger jars, Beijing is the preferred source of small cage-like jars. A well-known antique collector wrote in the 1930s that the jars made by Zhao Ziyu, an 18th-century Beijing artisan, were "worth more than 100 pieces of gold." However, the collector also points out that copies of Zhao's work were so common that the markets carried "no jars without the mark of Zhao." The nine jars in Field Museum's collection that bear Zhao Ziyu's seal are all quite ordinary in appearance and seemingly not older than the late 19th century. Three other jar-makers' names appear on other Beijing jars in the collection: Chen Guqing, Chen Shi, and Mingwei (fig. 8), none of which seem to be recorded in the cricket literature.

The lids of the Beijing jars, unlike most of those from Suzhou, have pierced circular plaques in their centers. The plaques are made separately, then inset into the clay of the lid. Most are molded of dark-fired clay and have the appearance of carved wood. Others are made of such materials as ivory, jade, or tortoise shell. The molded clay decorations, despite the modest cost of the raw material used, may be as finely made as those of more valuable substances.

Arenas and Beds

The lithograph in figure 4 contains two other kinds of cricket equipment which are usually of clay: fighting arenas and the small, curved boxes that serve as cricket beds. Field Museum has in its collection an exceptionally well-made arena, made of fine gray and black clays (fig. 10). The arena is unusual in having a central partition for separating the two combatants before fighting as well as a sliding door in the side through which the crickets can be driven in and out. This vessel was purchased by Laufer in 1923, in Suzhou City, and was made in Lumu. The Museum has another more coarsely made arena, also from Lumu, that resembles a somewhat enlarged cricket-keeping jar (fig. 10).

Fighting vessels of this size are for private matches watched by a few friends. For more public cricket matches, a larger arena is needed. The one in the lithograph may be of wood, but in general such contests are held in basin-like bowls that may or may not be specially made for the purpose. In Guangzhou (Canton) and Hong Kong, cricket specialists prefer wooden bowls as arenas or a type of ceramic bowl made in Shiwan ("Shekwan" in Cantonese), about 25 cm in diameter with sides 25 to 30 cm high, unglazed on the inside, and with green glaze on the outside. It is said

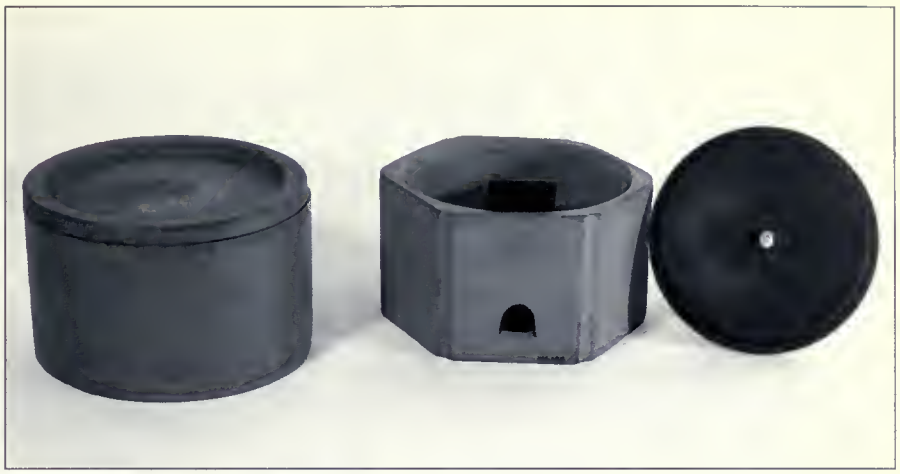
7. **Cottage Workshop** *at Lumu where modern cricket jars are made.* **Top left:** *Garden corner for preparing clay.* **Top right:** *Shaped jars stacked indoors for drying.* **Lower left:** *Jar-shaping equipment: slow turntable for final shaping, semicircular stand for steadying jars when applying decorations, and bow-string cutter.* **Lower right:** *Wooden seal blocks currently in use at Lumu. Lower right seal reads "Daqing Qianlong nianzhi" (Made in Qianlong, years 1736-95). Photo: Ho C.M.*

8. Earthenware Cricket Jars with Lids. Seal of Zhao Ziyu on exterior base. Beijing, 18th or 19th cent. Left: *Jar with slender waist, flat base, and reddish, polished surface. At center of lid is black clay plaque with molded openwork decoration showing horse under tree; diam. 5.8 cm; cat. 127800.* Middle: *Barrel-shaped jar, grayish black with polished surface. The molded black clay plaque in center of lid is ornamented with characters for "fortune," "promotion," "longevity," and "happiness"; cat. 127782.* Right: *Jar with 4 horizontal raised ribs, grayish black and polished. Here Zhao's seal is framed not by the usual rectangle but by leaf-shaped outline. Central plaque is raised into shallow dome; cat. 127789.*

9. Earthenware Cricket Jars with Lids. Beijing, early 20th century. Left: *Jar in elongated gourd shape, light brown. Three seals inside read "Linji" (the workshop), "Chengu," and "Qingzao" (the maker, Chen Guqing). The lid is black with central clay plaque molded with lily pond motif; cat. 127818.* Center: *Jar in gourd shape with flattened, light brown base. Four seals inside include the names of two makers, Mingwei and Chen Guqing, and a place or workshop name, Linpu. Black lid has openwork clay plaque with lotus pond and dragonfly design; diam. 5.7 cm; cat. 127771.* Right: *Jar in gourd shape with pointed, light brown base. Three seals on inside give the workshop name, Linji, and the maker's name, Chen Shi. Lid is missing; cat. 127795.*

that such bowls are no longer made, so they are greatly prized. When sold (which rarely happens) old Shiwan arenas fetch very high prices. We have never seen a specially made arena for public cricket matches from eastern or northern China. We believe they exist but have no idea what they are like, nor have we seen the famous basin-like arenas that are said to have been made in the Xuande period (A.D. 1426-1435) of the Ming Dynasty.

Also shown in the figure 4 lithograph is a small, fan-shaped object lying close to the fighting court. This is probably a cricket bed, used as a shelter for the cricket inside its jar and for transferring the insect from one container to another. Beds of this kind are among the oldest documented cricket utensils; three that were recovered from a tomb near Suzhou may be as early as the thirteenth century. Field Museum has a number of beds of this kind in its collection (fig. 11). Though none bear seals or other written evidence of their origin, they are believed to have been made in the Beijing as well as the Shanghai areas. One can still buy such cricket beds in bird-and-insect markets of those cities.



10. Cricket Fighting Arenas from Lumu, near Luzhou in eastern China (l. to r.): Cylindrical *earthenware cricket jar, probably used as an arena. The surface is light brown. A seal on lid underside reads "Lumu Town, outside the Gate of Qi, Gusu (Suzhou)." A seal on the outside of the base gives the potter's name, Xu Yuanshun; diam. 11.5 cm; late 19th-early 20th cent.; cat. 126393.* Hexagonal *earthenware arena with trimmed edges. Body is gray, lid and internal dividing wall are black. Vertically sliding door at the side is also black, but of wood. Seal on lid top reads* ju *(to bow down); another, inside the lid, gives the workshop location: "The lower bank north of Nanguangwei Bridge, Lumu Town, outside the Gate of Qi, Gusu (Suzhou)." On the outside of base is a third seal: "Made by Wang Yunqiao"; diam. 10.6 cm; early 20th cent.; cat. 126388.*

11. Earthenware Cricket Beos with both ends open. Early 20th century. Left: *Fan-shaped cricket bed, with lid removed (foreground), of gray clay. A seal reading* yang *("male") is impressed inside the base and on the lid, which is decorated with two mirror-image butterflies; Lumu?; cat. 112640-4.* Top right: *Gray, fan-shaped cricket bed. Finial of lid is inscribed with phrase "Hall of Peace and Permanence." Beijing? 4 cm high; cat. 127833.* Center: *Coffee-colored cricket bed, with floral design on top. Lid is not removable. Lumu?; cat. 233190-10.* Lower right: *Reddish cricket bed. Same as above except that lid is not removable. Lumu?; cat. 233190-8.*

The Future of Cricket Keeping

Cricket fighting and singing are still popular forms of amusement in China. Many men appear to have kept crickets as boys, and a surprising number continue to have an active interest as adults, despite official disapproval of anything that smacks of gambling and despite the bad public image of the sport. Over the centuries, Chinese attitudes toward cricket keeping have been rather like those of small-town Americans toward pool halls or racetracks: the sport is for idlers and ne'er-do-wells, undermining family finances and corrupting the youth. But cricket lovers continue to resist these pressures, and the sport remains popular, even fashionable. The markets are still crowded during the fighting season, and men of all ages continue to meet and chat endlessly about arcane details of cricket lore. True, the equipment involved is less costly and elaborate now than in former times, and it may be that the finest singers and fighters command lower prices. But for all that, cricket keeping seems very likely to survive, in China and perhaps in other countries where Chinese live. **FM**

Suggested Readings

All are available in the Field Museum Library

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EGYPTIAN MUMMIES: MYTHS, MAGIC and REALITY

by Frank J. Yurco
Egyptological Consultant

1. Mummy of Harwa, 8th cent. B.C., probably from Thebes. 87633

A Mummy Mystery

Among the more enduring favorites of the Field Museum's Egyptian collection are the mummies. Such popularity is part of a fascination that is long extant, and which has been reinforced by various media, especially in our century. Nearly every museum with Egyptian mummies has a story to tell, usually from the edge of reality, the twilight zone of human experience.

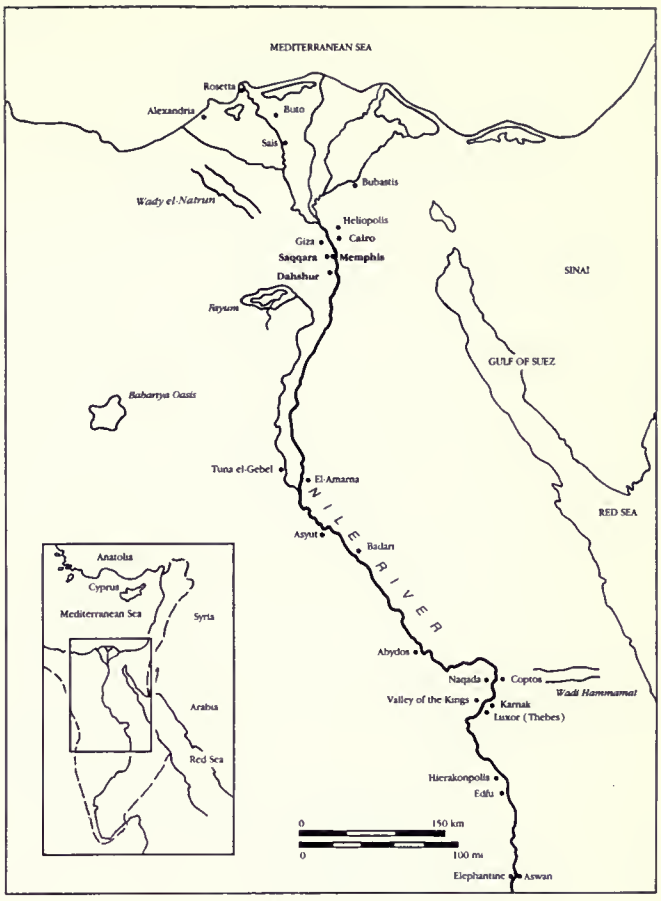
The Field Museum has its legend too—characteristically murky in detail and vague in description. Long-time readers of the *Field Museum Bulletin* may recall in the October 1974 issue, in the "Field Briefs" section, a short article, "The Case of the Screaming Mummy." A photo of the mummy of an official named Harwa (fig. 1) is next to the story as if to implicate him.

Having my own doubts about the story, I checked the source of the item, *The Track of Man,* a 1953 autobiography of Henry Field, a member of the Museum's curatorial staff from 1926 to 1941. There, the alleged incident is more fully recounted, and we learn that it took place in 1933. Field's text also establishes where it was supposed to have happened: in "a case about 125 feet long," with "a line of mummies. . . chronologically arranged"—an obvious reference to the long mummy case in Hall J, the old Egyptian exhibit.

The story further states that the case had but one door, and that the case was airtight and treated with

poison to keep out pests. In 1986, however, when the most recent renovation of the Egyptian exhibit began, the case was no longer airtight; access was still limited to one door, but the Hall J cases were not climate-controlled as in today's exhibit. As for the poison supposed to be in the case—was it lethal to humans? Probably not. The major target of the poison was moths, dermestid beetles, and such, suggesting that mothballs or similar chemicals had been used. And there had always been a certain amount of human traffic into the case, as curators, scholars, and maintenance staff did whatever they had to do. To be sure, between 1933 and 1986—more than half a century—there were some changes in the mummy case. For instance, a layer of sand was poured over the linoleum floor, presumably to lend a more authentic "Egyptian" look. The basic arrangement of exhibited materials, however, was little changed.

The mummy most readily suggested by Field's description is not Harwa, but that of a boy (cat. 30017), which was removed from the exhibit some years ago. This unwrapped boy's mummy (fig. 2) had been on exhibit in 1933, at the time of the alleged incident. His location was on a trestle, near the case door. He was long thought to have been the occupant of a small coffin (cat. 30016), identified as belonging to a boy named Hori—a convenient assumption because of the sequence of the catalog numbers. In 1986 Hori's coffin was near the door, suggesting that the unwrapped boy's mummy was also near the door, a juxtaposition I have been able to confirm.



ANCIENT EGYPT

2. Mummy of boy, 12-13 years old. This mummy was removed from exhibit several years ago. 49564

From this information we may construct a scenario for the story. Henry Field describes the mummy in the incident as "one of the naked, withered bodies," adding that "it had fallen off its base and was lying face down on the linoleum." How did the mummy fall off the trestle? A number of possibilities present themselves. Did some minor earth tremor strike the Chicago area in 1933, just strong enough to dislodge the mummy? Could strong vibrations from nearby street or railroad traffic have been responsible? Perhaps an employee with a key to the case was up to some mischief, trying to have a little fun by frightening other staff members on duty that night. Inspiration for such a prank could well have been horror movies with mummies, popular at the time, among them *The Mummy* (1932), starring Boris Karloff.

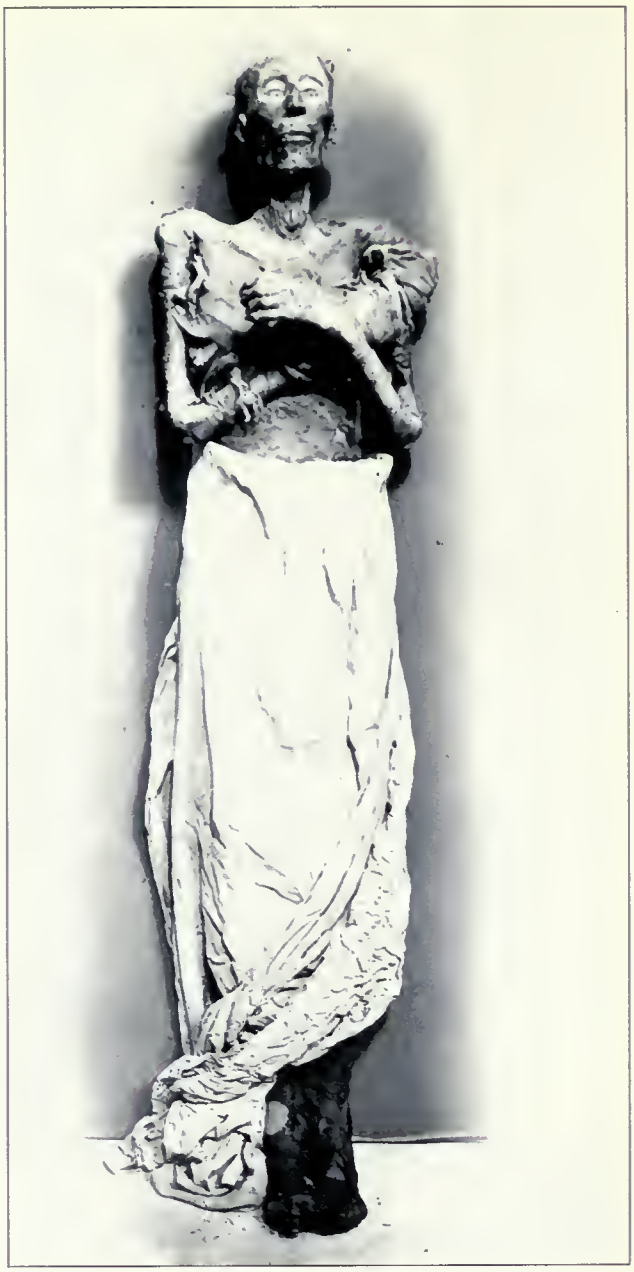
The Magic of Mummies

Mummies have this very special fascination for us, morbid and otherwise, because we know they were once live human beings, much like ourselves. Though as much as 4,000 years old, they commonly retain the hair, skin, and personal facial features that they possessed in life. Those that are still wrapped provide us with another kind of fascination: We know a mummy is inside—at least we suspect that is so. But what does that concealed mummy look like? Just exactly who is that person within? And certain mummies have a very personal mystique: Who would fail to be moved by gazing on the mummy of Pharaoh Ramesses II (reigned 1279-1212), now in the Cairo Museum (fig. 3), when it is more than likely that the face of this mummy is the very same that Moses looked into when he bargained for the Exodus of the Israelites, some 3,200 years ago?

Then there is the mummy of that pharaoh's father, Sety I (reigned 1291-1279). Gaston Maspero, a former director of Egypt's Antiquities Department, remarked that Sety's mummy (fig. 4), looked better than many living persons he was acquainted with.

While museum visitors may see in these preserved bodies something that is unnervingly close to life, the ancient Egyptians believed that mummies were able to speak, could move about and act—that they were truly alive. The Opening of the Mouth, the ritual intended to restore life, was performed on each mummy at its burial (fig. 5).

In an ancient Egyptian story, from a cycle set around the person of Setne-Khaemwas, we see a confrontation between a mummy of a deceased Old Kingdom noble and Setne (high priest of the temple of Ptah at Memphis, based on a real prince, son of Ramesses II). The deceased noble had illegally obtained an enchanted scroll belonging to the god Thoth. The possessor of this scroll had the power to converse with birds and fish and could actually see the solar god, Re, as the god sailed across the sky in his divine barque.



3. Mummy of Pharaoh Ramesses II, in the Cairo Museum. 2064

Possession of the scroll had cost the noble his life, as well as that of his wife and child. In exchange for a bribe, Setne learned of the scroll's whereabouts—in the noble's tomb—from a corrupt priest.

When Setne entered the tomb to seize the scroll,

4. Head of mummy of Sety I, Cairo Museum. 2065

the noble's mummy sat up and warned him of the consequences of being its possessor, but Setne persisted. The mummy, in response, challenged him to a game of senet for its ownership. Setne lost round one of the game, and the mummy whacked him over the head with the game board, driving him into the ground up to his knees. Setne lost round two as well, and again the mummy whacked him over the head, driving him into the ground up to his chest. Round three was also a victory for the mummy, who whacked Setne a third time, burying him to his chin. At this point, Setne called to his brother to bring him his magic amulets. With these, the loser was able to pull himself out of the ground and escape with the magic scroll.

After a series of adventures in which he suffered the calamities foretold by the mummy, the penitent Setne returned to the tomb and relinquished the troublesome scroll. He also found himself obliged to travel to Coptos for the bodies of the noble's wife and child and arrange for their reburial at the noble's side.

This story shows that the ancient Egyptians viewed the Afterlife as but an extension of the world of the living. The Afterlife was very real and concrete, and contact between the deceased and the living was very possible. The mummies of the deceased were not to be feared. Rather, they were deceased ancestors, relatives, and neighbors, living on in another postmortem existence. This belief system about ancestors is distinctly African. Other evidence of contact between mummies and the living is found in a class of documents called "letters to the dead"—texts written in ink on bowls left at the offering niches or tables with food or drink for the deceased.

In such letters, relatives of the deceased communicated with their ancestors, possibly expressing a need for help in a difficult situation, requesting aid against a personal foe, or responding to a visitation from the deceased relative or ancestor. In one such letter a widower remonstrates with his deceased wife who, he states, has been visiting him since he began thinking about remarriage. He assures her that he has performed all the requisite burial ceremonies and had faithfully kept up the offerings on schedule. In another visitation tale, "An Egyptian Ghost Story," a high

5. Drawing based on painting of Opening of the Mouth ritual, from the tomb of Roy, Dynasty XIX (*ca.* 1200 B.C.). 91016

6. Predynastic burial exhibit in the Field Museum, with woman's body, naturally preserved, *ca.* 3700 B C , Naqada I. 71913

priest living in Thebes visited the West Bank and a ruined tomb. While there, he had a visitation from the spirit of the tomb owner. The spirit had a complaint: his tomb had collapsed, so that the wind blew through it freely. The spirit asked the high priest to restore his tomb, but he was not very optimistic, since he had gotten nowhere with requests to four previous tomb visitors to restore it. The high priest, however, reassured the spirit and agreed to relocate and rebuild the tomb as well as reinstitute offerings for the spirit.

It is interesting to see how such concepts continued to survive, even into the period when Egypt became Christian. Coptic monks often set up their monastic cells in old, abandoned tombs that sometimes contained mummies. In one story from a cycle dealing with the Coptic fathers, a monk in such a setting strikes up a conversaton with a mummy. In good Christian vein, the mummy complains how its soul is suffering the pains of Purgatory because the deceased had died a pagan, and goes on to ask for the prayers of the good monk. Once more, we see the typical Egyptian interaction between the worlds of the living and the dead.

7. Coptic monastery showing, in background, Wady el-Natrun, where ancient Egyptians obtained natron, a principal ingredient in mummification process. Frank Yurco photo

The Art and Science of Mummification

Why were mummies made? The arid climate of Egypt has always been able to preserve bodies buried in the low desert environment beyond the Nile inundation levels. Such are the Predynastic bodies of Egyptians found grouped in prehistoric cemeteries; for example, the woman in the Museum's Predynastic burial group (fig. 6). Such bodies are naturally preserved, often in remarkable condition, because they were entombed in simple graves excavated on the desert outside the cultivated areas of the valley. There, moisture and humidity were low, and the dry sand and gravel plus the heat of the climate enhanced the preservation by drying of the body and any other perishable substances. Because of such natural preservation, no doubt, it was not difficult for the Predynastic Egyptians to think of the body surviving death, and so became convinced that this was part and parcel of survival in the Afterlife. This is demonstrated by the Predynastic practice of placing jars, palettes for cosmetics, tools and weapons, bodily ornaments, and even clothing and mats with the deceased in the tomb, and further, by the flexed position of the bodies themselves, suggesting the fetus in the womb and rebirth for the deceased.

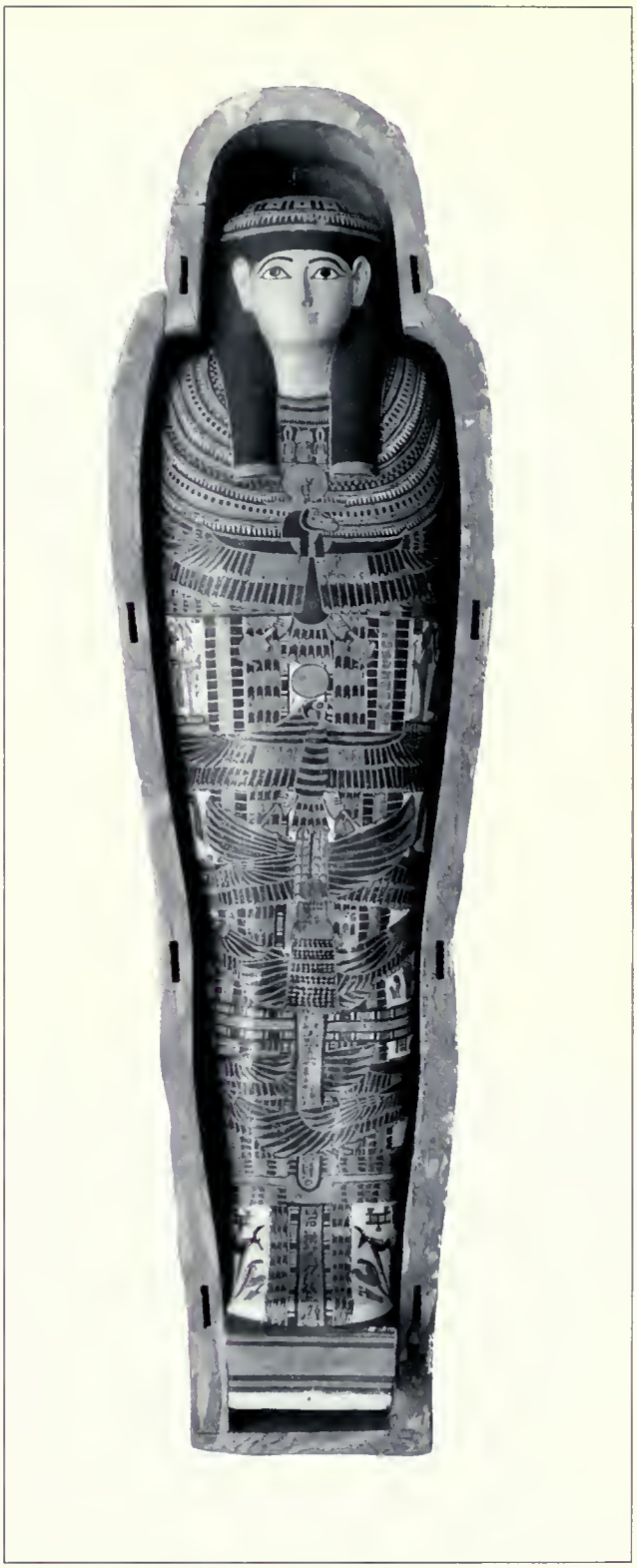
As social stratification began in the late Predynastic period, leading eventually to political unification of Egypt and the development of an elite class (*ca.* 3150 B.C.), the tombs of the elite became larger and more opulent. As the burial chambers were moved deeper underground for added security, the hot, drying action of the low desert burials was lost, and the bodies of the deceased decayed. This development clearly disturbed the religious sensibility of the Egyptians, and so, the first attempts at preserving the body artificially were made. By the time of the Ist Dynasty pharaohs, *ca.* 3100 B.C., an artificial mummification technique had been evolved. Egyptologist William Flinders Petrie, when excavating the Archaic cemetery at Abydos, found in the tomb of King Djer an artificially mummified arm that had probably been ripped from a woman's body, then stashed in the mudbrick wall of the tomb substructure. On the arm was a handsome bracelet of gold and turquoise, of Dynasty I workmanship. Already, linen wrappings were in use. The location where the arm was found indicates that another venerable tradition of Egypt was well under way—tomb robbing; and the jewelry on the arm provided a motive for the robbers. A few bodies of Ist-IInd Dynasty date from Saqqara indicate that the preservation process involved wrapping vast quantities of linen around the limbs of the deceased and molding these to restore the figure's form as it had been in life. This technique re-

8. Canopic jars in the Field Museum collection, made of limestone, Dynasty XXII. 91042

mained in use throughout the Old Kingdom, as attested by several mummies that remain from that date, including those in the recently discovered tomb of Nefer, from the Vth Dynasty.

Another technique attested from the Old Kingdom was the preservation of the body in a solution of natron. Natron is a naturally occurring compound of sodium carbonate and sodium bicarbonate that occurs in Egypt, especially in seasonally dried out lake beds, such as those found at Wady el-Natrun (named for the substance), located northwest of Cairo (fig. 7, and map). It was from here and several other sites that the ancient Egyptians obtained their natron. The chemical properties of natron made it a powerful dessicating and purifying agent. The word natron, indeed, is ancient Egyptian, with the same root as the word *netcher*, meaning "divine." Thus were natron's properties associated with religion and divinity. In the Old Kingdom reburial of Queen Hetepheres, mother of Khufu (builder of the Great Pyramid at Giza), her Canopic organs were found in their jars still steeped in a solution of liquid natron, after 4,500 years. An Old Kingdom sarcophagus recovered at Saqqara was still filled with a liquid solution of natron in which the tomb owner was steeped. We also know, from an inscription of Queen Meresankh III, that she spent 272 days undergoing mummification in the House of Purification. Thus, the Old Kingdom practice of mummification involved several methods, including one in which the soft internal organs (lungs, liver, stomach, and intestines) were removed and embalmed separately.

In the First Intermediate Period (2230-2040 B.C.), or in the early Middle Kingdom (2040-1786 B.C.), the 70-day process of mummification that we know of from later periods became standardized. The major differences from Old Kingdom practices were the shortening of the mummification process and introduction of dry natron. A description of the later process is to be found in Herodotus's *History of Egypt*, with supplemental details from other Greek authors. While no sequential account is found in Egyptian sources, archaeological and other evidence from the mummies themselves supports the basic accuracy of Herodotus's account. According to him, mummification was of three grades, depending on the ability of the deceased's relatives to pay. In ancient Egypt, responsibility for burying the deceased fell to the children or other relatives; the inheritance law was weighted in favor of the one who performed and paid for the burial. According to Herodotus, mummification was performed by specialists with workshops near the cemeteries. The



9. Coffin (mummy enclosed) of Chenet-aa, Dynasty XXII-XXIII. P-541

10. Heart scarab of Isis-em-kheb, wife of the high priest of Amun, Men-kheperre, Dynasty XXI, green nephrite, bottom, side, and top views. 2126

relatives brought the body to the shop, then selected the process to be employed and the quality of coffin and other furnishings.

In the costliest process, shown in the Egyptian exhibit's mummification diorama, the body was first washed. Next, an incision was made in the left flank, and the lungs, liver, stomach, and intestines taken out for separate mummification. Because these organs decay rapidly, they were removed and handled separately. The resulting cavities were rinsed out with palm oil and spices; sometimes they were filled with sawdust, sand, lichens, aromatic herbs and spices, or combinations of these. After mummification, the removed organs were placed into four containers, called Canopic jars (fig. 8). In some periods the embalmed organs were replaced into the body, with appropriate amulets attached, a less expensive process. The jars, first used in the Old Kingdom, had domed tops; in the Middle Kingdom they were given stoppers that resembled the tomb-owner's head, then in Dynasty XIX (1291-1185 B.C.) they were given stoppers with human, jackal, baboon, and falcon heads. These figures were known as the four sons of Horus (Horus himself being the son of Osiris). The four are often represented in the Books of the Dead—funerary texts written on papyrus rolls and placed with the deceased as guides to the Hereafter. These four figures were named Imsety (human-headed), in charge of the liver; Hapi (baboon-headed), in charge of the lungs; Dua-mut-ef (jackal-headed), in charge of the stomach; and Qebeh-senu-ef (falcon-headed), in charge of the intestines. The brain was sometimes removed through a breach made through the nose, but since the Egyptians did not consider the brain important, it was not preserved. The heart was almost always left in place, for it had to stand up for the tomb owner in the judgement before Osiris and the forty-two assessors, and had to be weighed against the goddess of justice or her feather.

After evisceration, the body was placed on a slanting table, covered with dry natron, and kept there for 40 days. This process effectively dessicated the body into a mummy, and it remained well preserved. Next, the body was returned to the shop, washed to remove all natron, then bandaged in strips of linen, up to 400 yards in length, to restore the semblance of life. In this 30-day process, amulets and jewelry and other items were placed into the wrappings with appropriate rituals. In the Museum exhibit, a mummy-shaped plexiglass construction standing before Harwa has affixed to it the amulets and other items in the positions in which they would be attached. It is the presence of gold and precious stones among such items that drew the attention of tomb robbers. Eventually, after 1085 B.C., most of these items were made of bluish-green faience, a glazed and fired material that did not

11. Scenes from the Book of Am-Duat, corridor of Merenptah, to the Osireion, Abydos. Ancient versions of hell are depicted.
Frank Yurco photo

appeal to robbers; hence, most surviving mummies are from this and later periods.

Finally, a coat of molten resin (later bitumen) was poured over the bandaged mummy to seal it. A woven net of beads of faience was sometimes placed over the outer bandages. Such a net may be seen on Harwa's mummy, near his feet. Finally, the completed mummy was placed into a shaped, wooden coffin. If the family could afford it, several coffins might be nested inside each other, along with the Canopic jars in their own chest. In the XXIInd Dynasty and later, the inner coffin was at times made of sheets of papyrus, glued together and molded in mummy form, plastered and painted elaborately, and lacquered, like the mummy of Chenet-aa (fig. 9). Such coffins might be nested in an outer wooden coffin, as in the case of Chenet-aa. Finally, in the Ptolemaic-Roman periods (332-30 B.C., and 30 B.C.-A.D.300), the bandaged mummy was placed within five pieces of cartonnage (molded from glued and painted papyrus sheets), with the face often gilded.

Gaining the Afterlife

After the relatives received the completed mummy and the Canopic organs, these were taken to the tomb, where the principal ritual was the Opening of the Mouth, intended to restore life and movement to the mummy and to give it a send-off to the realm of Osiris. This was the burial. A Book of the Dead papyrus roll might accompany the deceased as a guide through the Afterlife. In the late Old Kingdom, Osiris, originally a vegetation deity, was introduced as Lord of the Afterlife. What brought about this association was the story of Osiris—he had been murdered by his wicked brother Seth, then Isis had found his body and magically resurrected him. So Osiris, as a resurrected deity, came to offer resurrection to all Egyptians. This meant a major change, for in the Old Kingdom only royalty were assured resurrection, and all others placed their hopes in the king. This is why most tombs of Old Kingdom nobles are found clustered around the royal pyramid. The ordinary people in the Old Kingdom often retained the Predynastic burial traditions, or slight modifications of them.

With the introduction of Osiris, everyone could be resurrected; but whether or not this occurred depended on the sort of life that the deceased had led. A two-step judgement had to be passed to gain access to the realm of Osiris. The deceased was first questioned by 42 assessors about his conduct during life. This took place in the Hall of the Two Truths, so called because two figures of the goddess Ma'at, Goddess of Justice, oversaw the proceedings. Before each of the 42 assessors, the deceased made a statement of innocence regarding a category of wrongdoing. (See the Papyrus

12. Scene of Sen-nedjem and his wife Iy-nofret, in their tomb, at Deir el-Medinah, showing fields of the Blessed West.
Frank Yurco photo

of Isty in the Egypt exhibit and the diorama patterned on it.)

The statements of innocence involved denials of the following wrongdoings: committing falsehood against people, robbing, being rapacious, stealing, killing, destroying food supplies, doing any "crookedness," stealing the god's offerings, depriving an orphan of his property, lying, stealing food, being sullen, transgressing, killing a sacred bull, committing perjury, stealing bread, eavesdropping, babbling, disputing in court except about one's own property, committing homosexual acts, misbehaving, causing terror, being hot-tempered, being deaf to words of truth, making disturbance, hoodwinking, misconducting one's self or copulating with a boy, being neglectful, being quarrelsome, being unduly active, being impatient, washing out the image of a god, being voluble in speech, doing wrong or seeing evil, making conjuration against the king, wading in water, being loud-voiced, reviling god, opposing a god in his procession, becoming wealthy except by one's own property, blaspheming god in one's city.

This list forms Spell 125 of the Book of the Dead, and further details serve as its introduction, while a prayer and the questioning of the deceased follow the list. This forms an extraordinarily tough moral standard. Remarkably, from the Middle Kingdom, when the judgements were introduced, onwards in Egyptian history, surviving texts mark a stronger sense of morality and accountability. Even kings became subject to this set of judgements. The stage next to the judgement involved the weighing of the heart on a balance scale against the feather of the goddess Ma'at, mistress of Justice.

At this stage, the veracity of the statements made before the 42 assessors was tested. Woe to the deceased whose heart did not balance the feather of the goddess of Justice! At the side of the scale a monster, Ammit, stood ready to devour the errant soul. To help the deceased through these judgements, the heart scarab was included with the mummy (fig. 10). The scarab was inscribed with Spell 30B of the Book of the Dead, which called upon the heart not to testify against its owner in the judgement before Osiris. The heart scarab was almost always included in the wrappings of the mummy to accompany and protect its owner in the Afterlife. For this reason also, the heart was not removed from the body during mummification. To the Egyptians, the heart was responsible for actions, emotions, and thought. Should the heart fail to balance with the feather of truth, torments even worse than those presented by Ammit might be in store. The ancient version of hell is presented in the story of Setne-Khaemwas and Sa-Osiris, and in scenes from the Book of Am-Duat (fig. 11).

13. Pharaoh Akhenaton, Dynasty XVIII, reigned 1350-1334 B.C. Detail of statue in the Cairo Museum.
Frank Yurco photo

If the heart passed the judgement by balancing with the feather or figure of Ma'at, then the deceased was united with Osiris (becoming as Osiris) and entered eternal life. Through Osiris he was resurrected as a potent spirit and went on to live in the Fields of the Blessed. Resurrection was thus based upon the resurrection of Osiris himself through the magic and agency of Isis, after he had been murdered by his brother Seth. In the realm of the Blessed Dead, Hathor of the West offered a cool drink to the soul (the *ba*, depicted as a bird whose head was that of the deceased), and the deceased lived among all the others who had gone before. This Afterlife world was patterned upon Egypt itself, but in the Afterlife the Nile always rose to exactly

the right level, and the grain grew to a height unknown in the land of the living (fig. 12). As in Egypt, the deceased might still be called upon to perform compulsory communal tasks, such as canal clearance, dike maintenance, or hauling sand.

To escape these tasks (which the living Egyptians also were eager to avoid) the deceased was buried with small, inscribed mummiform figurines, called *ushabtis*, literally "one who answers." Usually made of glazed faience, but sometimes of metal, wood, or stone, ushabtis were inscribed with Spell no. 151 of the Book of the Dead. While the Afterlife was ruled by Osiris, as Judge and Ruler, it represented, nonetheless, a "democratization." Everyone, pharaoh to *felahin* (peasant), was expected to undergo the judgement; no one was exempt, nor could one bribe one's way out of it. This contrasted sharply with Old Kingdom belief that pharaoh alone, being a god, was self-resurrected after death, and either stormed heaven, dominating the gods there, or joined the imperishable, eternally visible, northern circumpolar stars, as described in the Pyramid Texts. The royal family and nobles who grouped their tombs around the pharaoh's pyramid expected to be resurrected to serve pharaoh in his Afterlife. Meanwhile, the common folk continued burial in the Predynastic style, or in smaller tombs, and maintained their own belief in survival after death. The introduction of Osiris as ruler of the Afterlife in the late Old Kingdom completely changed this older belief system.

To the Egyptians, the soul of the deceased could communicate with the living. The soul took two principal forms: the *ka*, a double of the body that stayed in the tomb, and the previously mentioned *ba*, depicted as a bird with a human head, that could venture from the tomb and visit relatives. These visitations of the *ba* were neither malevolent nor mischievious. Rather, they might occur because the spirit had some need, or because it disagreed with the actions of living relatives, or because the spirit had been called upon by relatives to help them in some cause (see p. 19 above).

This strong belief in life after death exercised a powerful hold on the ancient Egyptians. When Pharaoh Akhenaton (1350-1334 B.C., fig. 13) tried to abolish all deities but the solar deity Aton, it was the denial of assurance in the resurrection through Osiris and Isis

14. View of Osireion, built by Sety I (1292-1279 B.C., Abydos. In Osireion was recreated the tomb of Osiris. Frank Yurco photo

15. Reconstructed pyramid-topped tomb chapel at Deir el-Medinah.
© Margaret Sears

that was the most grievious loss for average Egyptians. After Akhenaton died, there was a rapid return to orthodox worship, and special emphasis was laid on the power of Osiris. Both Sety I (reigned 1291-1279 B.C.) and Ramesses II (reigned 1279-1212 B.C.) built impressive temples to Osiris at Abydos. Merenptah (reigned 1212-1202 B.C.) added to Sety I's Osireion, the access corridor with scenes from the Book of Am-Duat (see fig. 11). The Osireion itself (fig. 14) recreated the tomb of Osiris. In private tombs, scenes and texts from the Afterlife cycle largely replaced the daily life scenes that had been popular in pre-Akhenaton Dynasty XVIII private tombs.

The Osiride Religious System

Osiris now began to acquire aspects of the solar deity Re. In Egyptian belief, Re sailed over the sky in a boat, as already noted. He rose daily as Khepri (the scarab beetle) in the morning; at midday, he appeared as the solar disk, the Aton; in the evening he appeared as the ram-headed Atum. As Re-Atum, the sun-god passed in his divine barque into the Afterlife realms after setting in the western horizon. There, Re-Atum illuminated the faces of the deceased with the light of life. Thus, the reason for giving mummies gold or gilded face masks—to reflect this light of life and associate themselves with Re-Atum. In the doorways of many Ramesside period tombs the owner is shown adoring Re and praying to him. On the pyramid that capped many New Kingdom chapels, one niche was cut on the eastern face and another on the western face (fig. 15). Small statues of the tomb owner, often holding a stela with a prayer to Khepri or Re-Atum, were placed in these niches (fig. 16).

By Dynasty XIX, such belief in the aspects of divinity led to a remarkable trinitarian statement of theology: all gods and goddesses were but aspects of Amun, Re, or Ptah, and these three were themselves aspects of Amun, or of each other; Amun could be one of them or all three. In solar belief, a similar trinity was depicted in royal tombs at Thebes in the relief work (fig. 17), in which Khepri and Re-Atum stand inside the solar disk, Aton. The solar deity likewise became a powerful resurrection symbol, for as he journeyed through the fourth and fifth hours (the darkest) of the night, he was transformed from Re-Horakhty, the dying sun, to Khepri, the resurrected sun that rose triumphantly each morning. This explains the popularity of scarab beetles or winged scarab beetles as amulets in mummy wrappings. The assimilation of Osiris to Re and other deities is illustrated by the Ptah-Sokar-Osiris figures popular in the Late Period (664-30 B.C.). These often have gilded faces and wear the horns, sundisk, and plumes of the solar deity, figure 18.

Similarly, in this Late Period, especially 332 B.C.-A.D. 300, the belief in Osiris and Isis spread beyond the borders of Egypt, at first through the political empire of the Ptolemaic rulers (323-30 B.C.). Later, the belief moved on to Rome. Here, despite legal restrictions and bans under Augustus and the early Julio-Claudian emperors, by the reign of Claudius (A.D. 41-54) the Osiris-Isis cult was granted legal status. Belief in Osiris and Isis offered three major tenets that had great appeal in the Graeco-Roman cultural milieu. Isis offered women equality with men, just as she had done in Egyptian society. Through Isis, the believer could undergo the Osiride mysteries, involving resurrection and eternal life. Further, Isis had power over destiny and fate, and could undo the curses of witches. In Apuleius's *The Golden Ass* (2nd cent. A.D.), the protagonist angers a witch, who then turns him into an ass. In this form he wanders the Roman Mediterranean world until he is sold to an arena. This means almost

16. Niche statue of the scribe Amenhotep, holding stela with hymn to sun deity, probably from Thebes. Dynasty XVIII. 95021

This was the threefold appeal of the cult of Isis and Osiris, and it filled several voids that were not served, or were poorly served by the indigenous classical deities. The cult's widespread popularity is demonstrated by the many sites where images of Isis or Osiris, or archaeological remnants of their shrines, have been found, scattered throughout the Roman Empire and even beyond its borders in Central Europe. The twofold appeal of the cult, resurrection and eternal life, and power over fate made the Isis-Osiris cult a stiff competitor for early Christianity, and its appeal to women exceeded even what Christianity could offer. Along with Christianity, the Romans classed the cult as one of the Oriental mystery cults.

As in Christianity, the followers of Isis and Osiris were expected to improve their moral attitudes, for after death they had to face the old Egyptian judgement of the deceased, first before the 42 assessors, then in the

17. Solar trinity, Khepri and Re-Atum, standing inside the solar disc, Re-Aton (center); from tomb of Merenptah, Valley of the Kings, Dynasty XIX.
Frank Yurco photo

certain death. Fearfully, the night before he is to be exhibited, he lays down on the seashore and prays. Isis appears and instructs him on how to achieve redemption. The next morning he is to join a procession of devotees of Isis. He is to find the high priest and nibble the roses he carries. The next day, following instructions, he locates the priest, eats the roses, and regains human form. He then joins the cult of Isis, ultimately undergoing the Osiride mysteries that probably concerned the resurrection and life after death.

weighing of the heart. Vignettes of both stages remained popular in Books of the Dead, even of the Ptolemaic-Roman Period. (See the papyrus of Pa-di-Hor-pa-khered, cat. 31325, in burial group 7 of the Egyptian exhibit, and in the papyrus cat., 31324, even later in date.) Finally, the appeal of Isis to women, with tenets of equality with men and an equivalent dignity, was something that Christianity could not then offer.

Two factors that helped Christianity emerge victorious were (1) it appealed to the poor—by con-

trast, the cult of Isis and Osiris required a substantial financial outlay in addition to the moral commitment, and (2) the Isis-Osiris cult had been granted legitimacy early in the Imperial period, something Christianity didn't achieve until the reign of Constantine (A.D. 312-337). So, Isis and Osiris were part of the Roman establishment, while Christianity was outside of it. As the early church fathers recognized, the blood of the martyrs was the seed of the church.

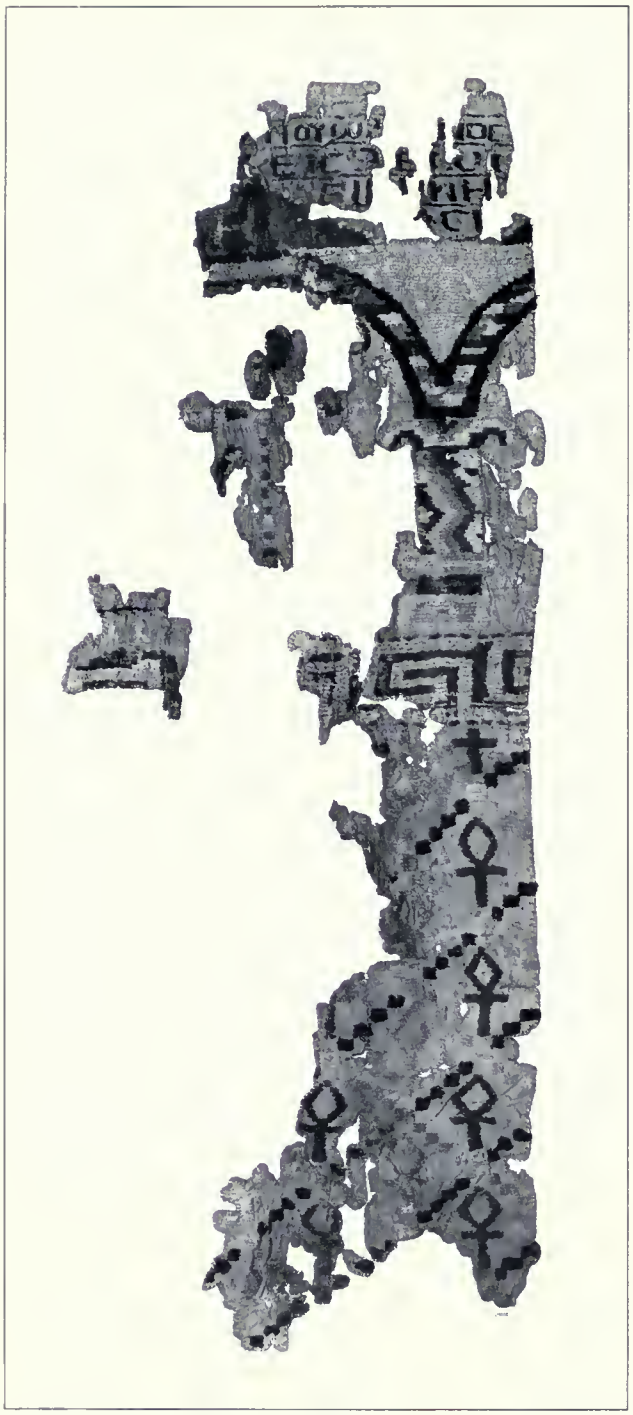
By the early third century A.D., the cult of Isis and Osiris also faced the competition of newly arriving mystery cults, such as that of Mithra, a Persian cult with strong appeal to men. In Egypt itself, there were also new restrictions against Egyptian pharaonic religion. The Romans ridiculed Egyptian religion with its myriad forms of deity, including animals, reptiles, even insects, and the power and influence of the temples was curtailed sharply. In the Ptolemaic Period, it had been the temples and priesthoods that preserved and nurtured Egyptian nationalism. Now, under Roman rule, Egyptians were fourth-class people, ranked after Roman citizens, Greeks with Alexandrian citizenship, and Jews in a system created by Augustus that comes strikingly close to South African-style apartheid. In Egypt, the indigenous religion was seen to have failed to rid the nation of foreign domination. The large number of Greek settlers dating back to the Ptolemaic era led to growing Hellenistic influence. While many Greeks adopted Egyptian funerary traditions, even there, Greek artistic influence appears.

Into this milieu the early Christian missionaries entered, probably in the first century A.D. Initially, Christianity's strongest gains were in Alexandria, especially in the extensive Jewish community. Later, the many parallels with Egyptian religion, especially Isis and Osiris, made the Christian message sound familiar to indigenous Egyptians, and Christianity penetrated into the Nile Valley proper. By the 2nd-3rd century A.D., Christianity had a strong hold throughout Egypt, especially among the poorer, common folk.

Meanwhile, by the 2nd century, a prominent and influential theological Christian school developed in Alexandria under teachers and leaders such as Pantaeus, Clement, and Origen. This school, steeped in Greek Platonic philosophy but also knowledgable about Egyptian culture, was instrumental in developing early Christian theology. Not surprisingly, some Egyptian religious ideas made their way into Christianity. Egyptian trinitarian ideas helped to explain the Christian Trinity; Origen speaks of Christ and the Holy Spirit as aspects of God, the Father in a fashion that harkens back to Ramesside speculations and depictions (fig. 18). And it is not surprising to see the Alexandrian school championing the idea of the Virgin Mary as God-bearer. Isis, mother of Horus, offered the parallel here as well as the imagery. This helped fill the void of feminine influence in Christianity to an extent (but still not to the extent of Isis in Egyptian religion). The Osiride resurrection, and the concept of judgement of the dead offered other parallels that Christianity used. The Egyptian Coptic Christians saw many of these parallels as prefigurations of Christianity.

18. Ptah-Sokar-Osiris statuettes in wood, painted and gilt. 105202

Most prominently, the pharaonic hieroglyph ☥ *ankh*, meaning "life," that in Egyptian religion was bestowed by deities upon pharaohs and humans, to the



19. Fragments of Coptic wall hanging; arched structure with Coptic text, ankh signs and crosses in field; wool on linen, 5th-6th cents. A.D 71863

Copts prefigured the cross, and not just the cross, but the cross triumphant, the cross that gives life. Thus, this hieroglyph survives in Christian iconography as the *crux ansata*. The Copts used it interchangeably with the more familiar cross (see fig. 19). The utilization of Isis, mother of Horus, to develop the iconography of Mary, mother of Christ, helps to explain the several cults of the Black Madonna found in European locales. It was the Romans who first enunciated a racial distinction for the Egyptians. On the average, because the Egyptians were darker than Romans, they were classed as "blacks." Thus, Isis, an Egyptian goddess par excellence, could be viewed as "Black" Isis. As Europe was Christianized, the utilization of the iconography of Isis, mother of Horus, for the iconography of Mary, mother of Christ, included Isis' skin complexion and all. So ended the long pharaonic tradition of Isis and Osiris and the belief in resurrection and life after death. Not surprisingly, then, viewing some of these Egyptian traditions nudges deeply held concepts of Museum visitors coming from a Christian tradition. **FM**

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I certify that the statements made by me above are correct and complete. *Jimmie W. Croft*, vice president for Finance and Museum Services.

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COVER

"A View at Anamooka," engraving by J. Webber, from the atlas to Capt. James Cook's *A Voyage to the Pacific Ocean* (3 vols.), London, 1784. The island of Anamooka, today called Nomuka, is in Tonga, in the South Pacific. The first edition set of this work is in the Field Museum's Mary W. Runnells Rare Book Room and came from the library of Stanley Field, president of Field Museum from 1908 to 1964. Color was added to Webber's engraving by Sophia Anastasiou-Wasik, Department of Photography.

1990 Calendar

As usual, Field Museum members will be receiving an appointment calendar for the next year. For 1990, however, members will receive – in lieu of a *Bulletin* calendar – the beautiful 15-month calendar published by the Field Museum Women's Board. In addition to the twelve months of 1990, the Women's Board calendar includes the last two months of 1989 and the first month of 1991. The calendar's superb photos, 15 in all, feature artifacts from the Museum's spectacular new exhibit, "Traveling the Pacific." The *Bulletin* editor wishes to thank the Women's Board for making this superb publication available to the general membership.

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EVENTS

Adult Programs

In celebration of the opening of Field Museum's newest permanent exhibit, "Traveling the Pacific," adult programs feature the people and natural history of this region. Choose from a variety of weekend and evening courses. Please use coupon on p. 4.

"Traveling the Pacific": A Walk-Through
Phyllis Rabineau, Senior Exhibit Developer, Field Museum

Explore Field Museum's newest exhibit, "Traveling the Pacific." The program begins with an introduction to the Pacific region and suggestions for viewing the different sections of the exhibit. Participants are then free to explore the exhibit on their own. Senior exhibit developer Phyllis Rabineau is available throughout this time to answer questions. Please indicate a second choice of date for this class.

AC89301 Thursday, Nov. 16
AC89302 Wednesday, Nov. 29
(1 session each date)
7:00pm-9:00pm $10 ($8 members)

"Mythologies of Oceania"
Steven Poser, Lecturer, Department of Philosophy, Empire State College, and State University of New York, Hudson Valley Center

Myths from the Pacific peoples are as rich and as varied as the cultures they represent. Listen to and discuss some of the beautiful and exciting mythic narratives from Polynesia, Melanesia, and Micronesia. Examine the relationship of myth to the natural environment of the Pacific and recurrent motifs within Oceanic cosmology.

AC89303 Saturday and Sunday, 10:30am-3:00pm
Dec. 2 and 3 (2 sessions)
$50 ($40 members)

"Ring of Fire: The Pacific Ocean Basin"
Paul Sipiera, Professor, Department of Physical Sciences, Harper College

Examine the geology of the early Earth from solar system formation to the beginning of plate tectonics. Focusing on the Pacific Ocean Basin, discuss the geological processes involved with earthquakes and volcanoes in the area known as the "ring of fire."

AC89304 Tuesdays, 7:00-9:00pm
Oct. 31 - Nov. 21 (4 sessions)
$50 ($40 members)

"Kali-Eskrima: A Filipino Martial Art"
Nathan Defensor
Founder of The Filipino Kali-Eskrima Academy of Chicago

The Philippine Islands have a long history of warrior traditions used to defend the homeland. Kali-Eskrima is a traditional martial art using sticks, knives, or bare hands for self defense. Learn the basics of Kali-Eskrima while studying the history and culture of the Philippine people. Participants should expect to spend an additional $12 on supplies.

AC89305 Wednesdays, 7:00-9:00pm
Nov. 1 - Dec. 6 (6 sessions)
$60 ($50 members)

Weekend Tour Programs

Each Saturday and Sunday you are invited to explore the world of natural history at Field Museum. Free tours, demonstrations, and films related to ongoing exhibits at the Museum are designed for families and adults. Listed below are some of the numerous activities offered each weekend. Check the activity listing upon arrival for the complete schedule and program locations. The programs are partially supported by a grant from the Illinois Arts Council.

November

4, 18 12:30pm. "*Museum Safari.*" A trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon and an Egyptian tomb, big game from Africa and seals from the Arctic.

5, 19 12:30pm. "*Welcome to Field Museum.*" Enjoy a sampling of our most significant exhibits.

December

2 1:30pm. "*Tibet Today and a Faith in Exile.*" This slide lecture focuses upon Tibetan refugees in India: Dharamsala, Darjeeling, and Sikkim, and includes slides of the dedication ceremony of a Himalayan temple in Indiana by His Holiness the Dalai Lama.

3, 17 12:30pm. "*Welcome to Field Museum.*" Enjoy a sampling of our most significant exhibits.

9 12:30pm. "*Museum Safari.*" A trek through the four corners of the Museum to see the seven continents. See antiquities from the Amazon and an Egyptian tomb, big game from Africa and seals from the Arctic.
1:30 pm. "*Tibet Today and Bhutan: Land of the Thunder Dragon.*" See Lhasa and other towns now open to tourists, and examine important Buddhist sites during this slide lecture and tour.

EVENTS

World Music Programs

Weekends in November and December
1:00pm and 3:00pm

Program Highlights include:

☐ *Nov. 4, 5*
1:00pm—Eli Hoenai demonstrates African percussion
3:00pm—Fan Wei-Tsi demonstrates the *sheng*, a Chinese zither

☐ *Nov. 10, 11*
1:00pm—Eli Hoenai demonstrates African percussion
3:00pm—Darlene Blackburn demonstrates African dance

☐ *Nov. 18 (Saturday)*
1:00pm—Light Henry Huff plays jazz harp
3:00pm—Musa Mosley demonstrates African drumming

☐ *Nov. 24 (Friday)*
1:00pm—Light Henry Huff plays jazz harp
3:00pm—Musa Mosley demonstrates African drumming

☐ *Nov. 25, 26*
1:00pm—Shanta delights with African stories and song
3:00pm—Thunder Sky Drummers perform using African percussion instruments

☐ *Dec. 2, 3*
1:00pm—Eli Hoenai demonstrates African instruments
3:00pm—Fan Wei-Tsi demonstrates the *sheng*, a Chinese zither

☐ *Dec. 9, 10*
1:00pm—Musa Mosley teaches African drumming
3:00pm—Librado Salazar plays classical guitar

☐ *Dec. 16, 17*
1:00pm—Chinese Music Society of North America demonstrates instruments from the Chinese orchestra
3:00pm—Keith Eric performs Jamaican music and tells stories

☐ *Dec. 26, 27 (Tues., Wed.)*
1:00pm—Thunder Sky Drummers play African percussion
3:00pm—Chicago Beau plays blues harmonica

☐ *Dec. 28, 29 (Thurs., Fri.)*
1:00pm—Light Henry Huff plays contemporary jazz harp
3:00pm—Eli Hoenai demonstrates African instruments

☐ *Dec. 30, 31*
1:00pm—Musa Mosley teaches African drumming
3:00pm—Keith Eric performs Jamaican music and tells stories

The World Music Program is supported by the Kenneth and Harle Montgomery Fund and a CityArts grant from the Chicago Office of Fine Arts, Department of Cultural Affairs, and the Illinois Arts Council, a state agency. These programs are free with Museum admission and tickets are not required.

Adult-Child Workshops

Adult-child workshops offer an exciting, participatory learning experience. Children and adults work together to discover fossils, join in a Hawaiian luau, or make shadow puppets. Workshops are designed for specific age groups from 2-year-olds to 13-year-olds. For a full listing of workshops and registration information, call the Department of Education at (312) 322-8854 or consult the November-December Adult, Children, and Family Programs brochure.

Registration

Be sure to complete all requested information on this registration application. Advance registrations are confirmed by mail. For registrations received less than two weeks before the program date, confirmations are held at the West Door for pick-up one hour before the program begins. Phone registrations are accepted using Visa/Master Card/AMX/Discover. Please call (312) 322-8854 to register. The minimum amount for credit cards is $15.00. For further registration information, consult the November/December Adult, Children, and Family Program Brochure.

Return complete registration with a self-addressed stamped envelope to:

Field Museum of Natural History
Department of Education, Program Registration
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605-2497

Name _____

Address _____

City _____ State _____ Zip _____

Telephone: _____ Daytime _____ Evening

Program Number	Program	#Member	#Nonmember	Total Tickets	Amount Enclosed

☐ Scholarship requested

Total _____

☐ AMX ☐ Visa ☐ MasterCard ☐ Discover (Check one)

Card # _____ expiration date _____

Signature _____

For office use only: date received _____ date mailed _____

EVENTS

Vanishing Rain Forests: The Earth in Crisis

Field Museum's landmark lecture series continues Saturdays, November 4-18. Please use coupon on p. 4.

Saturday, Nov. 4, 2:00pm
"*The Threat to the Living World*"
Peter H. Raven, Director,
Missouri Botanical Garden

The combination of rapid human population growth, widespread poverty, and an inability to put sustainable systems of agriculture into place are bringing about the most extensive episode of extinction since the dinosaurs disappeared. The consequences of this extinction must be considered and intelligent choices made now for the benefit of our children and grandchildren.
LL89303
$5.00 ($3.00 members)

Saturday, Nov. 11, 7:00pm
"Population Growth and the Destruction of Tropical Forests"
Paul R. Ehrlich, Bing Professor of Population Studies,
Department of Biological Sciences, Stanford University

Human population growth has major global impacts. In tropical forest regions, this growth contributes to the demand for land. It increases the demand for forest products worldwide. Indirectly, it contributes to deforestation, which may lead to global warming, ozone depletion, and acid rain. What steps can be taken to protect the forests and the earth.
LL89304
$5.00 ($3.00 members)

Saturday, Nov. 18, 2:00 pm
"Biodiversity and the Tropical Forest"
Russell A. Mittermeier, President
Conservation International

Plant and animal species of the tropical rain forests are being destroyed so rapidly that we will never know their scientific value or even know of their existence. Focusing on primates and their tropical forest habitats, examine recent extinctions and the critical need for conservation efforts.
LL89305
$5.00 ($3.00 members)

For additional information on "Vanishing Rain Forests: The Earth in Crisis," contact the Department of Education at (312) 322-8854 or consult the November/December Adult, Children, and Family Programs Brochure.

Also in November-December. . .

Begin to unlock the secrets of Egyptian hieroglyphs, study the archaeology of the eastern United States, embroider traditional Mexican designs, or learn to force spring flowering bulbs to bloom indoors this winter. For a full listing of adult courses and workshops, consult the November-December Adult, Children, and Family Programs brochure or call the Department of Education at (312) 322- 8854.

Lime mortar made of carved wood (detail) from Trobriand Islands, Papua New Guinea.
Ron Testa and Diane Alexander White

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Lagoon beach side of recreated coral island in the new exhibit, "Traveling the Pacific." Diane Alexander White

Traveling The Pacific

Field Museum's Newest Permanent Exhibit

by Phyllis Rabineau
Senior Exhibit Developer

What are the first thoughts that come to mind when you hear the words "Pacific islands"? If you're like most of the hundreds of Field Museum visitors we asked, you probably think of palm trees, blue water, and white sandy beaches. Perhaps you think of exploding volcanoes, or of coral reefs teeming with exotic fish. Maybe you've vacationed in Hawaii, or fought at Guadalcanal. You probably know the story of the mutiny on HMS *Bounty*, or about the voyage of the raft *Kon Tiki*. You've seen Gauguin's Tahitian paintings, or read island tales by Maugham, Stevenson, Melville, or Michener.

For more than two centuries, Pacific islands have captured the imagination of westerners. We tend to think of them as lush, exotic environments—as paradise where native peoples live easy lives. But how much of that is true?

In the United States, little public education has been devoted to Pacific islands, and few museums have comprehensive exhibitions about them. The Field Museum, housing one of the world's greatest collections of artifacts from Pacific cultures, is uniquely qualified to help our visitors learn more about the islands and their peoples. The Museum's new exhibition program, emphasizing innovative techniques and interdisciplinary topics, provides an opportunity to enhance public understanding of this enormous (and little-understood) part of the world.

Supported by generous funding from the Regenstein Foundation, the National Endowment for the Humanities, the National Science Foundation, and the Chicago Park District, a staff of fifty exhibit developers, designers, and preparators aided by nearly two dozen scientific consultants has been at work behind the scenes for three years, planning the Regenstein Halls of the Pacific, new exhibit spaces devoted to Pacific islands. The first results, a 10,000-square-foot installation entitled *Traveling the Pacific*, opens this November. When the second phase is completed a year from now, the Field Museum will have more than 17,000 square feet of exhibit space devoted to Pacific islands, the largest exhibit the Museum has yet produced.

Traveling the Pacific incorporates a geographic orientation to the islands and introduces many aspects of their natural and cultural history. The final phase of the Pacific installation, opening in November 1990, will constitute a closer look at the rituals and ceremonies of Pacific peoples, emphasizing their spectacu-

lar art objects. It's the broadest goal of this exhibit to increase public understanding of, and respect for, these faroff islands and their peoples. Using the metaphor of an imaginary journey, we'll visit many unfamiliar islands, as well as highlight unexpected facts about well-known places.

Where Will Our Travels Take Us?

Traveling the Pacific uses many imaginative techniques to provide visitors of all ages with information about the ocean, the land, and the plants, animals, and peoples that inhabit about a third of Earth's surface. (The area included in the exhibit is shown on the map on page 16.) The story concerns a few big islands, notably New Guinea and New Zealand, and many thousands of small islands, some no more than tiny specks of land. Most are so small that their scale must be greatly exaggerated just to be shown on a map.

This range of island sizes, compounded by their distribution over a huge geographic area, makes for a great variety of environments: rugged mountains, low-lying swamps, tropical forests, and nearly barren sandspits. On some islands plants and animals have lived in isolation for millions of years and have evolved in unique ways. Adapting to these environments, and experiencing change over thousands of years, the human cultures have also become extremely diverse.

In short, *diversity* is an important characteristic of Pacific islands. No single picture, object, or phrase can sum them up, and no exhibit can tell you everything about them; it can only provide an introduction.

Geography and Geology

No one has really counted, but geographers estimate that there are between 20,000 and 30,000 islands in the Pacific. The biggest one, New Guinea, is the second largest island in the world. (Only Greenland is larger.) It covers about 306,000 square miles, the size of Texas and Kentucky put together. The smallest islands are just piles of coral rock that barely rise above ocean's surface.

Traveling the Pacific will help our visitors learn about the geography of these remote islands using a unique orientation method. At the entrance to the exhibit, you'll find a large map made from ceramic tiles, spread across the floor. A sign invites you to take an "Island Hop Across the Pacific," to walk on the map and discover the names and locations of hundreds of islands. You can measure your foot against a scale of miles, and pace off distances. You'll find it's more than 8,000 miles from Chicago to New Guinea!

How did all those islands get there? That's the topic covered in the first major section of *Traveling the Pacific*, and as you might expect, there's no single answer to that question; it depends on which islands you consider. We'll take a closer look at one process of island formation.

In some places deep below the Pacific seafloor are stationary "hot spots," where molten rock from within the earth pushes up to form a volcano. Over time, the volcano may grow large enough to rise above sea level and build an island. We're not sure exactly how many hot spots are under the Pacific seafloor, but geologists think there might be about ten. Coupled with tectonic movement, those few hot spots have built thousands of mid-ocean islands.

The Pacific Plate, that part of Earth's crust which lies beneath most of the Pacific Ocean, is moving northwest at the rate of about four inches a year. As it travels, the plate carries newly created volcanic islands away from their hot spot sources. Over millions of years, these volcanic islands erode and subside into the sea; coral torn from underwater reefs piles up around them to form rings of low islands called *atolls*.

The hot spots stay fixed in place, and their continued eruptions form new islands. Each island is carried away by the moving plate, and each goes through the process of erosion and subsidence. Like products on an assembly-line conveyor belt, chains of islands are carried on the moving Pacific Plate.

The best known island chain is the Hawaiian group, with hot spot volcanoes Mauna Loa and Kilauea still active on the "Big Island." Islands northwest in the Hawaiian chain show the process of aging—those farthest from the hot spot are oldest. Other island groups formed long ago by hot spots include the Society Islands, the Marshall Islands, the Gilberts, and the Carolines.

Traveling the Pacific highlights the story of island chains with a variety of media. We've recreated an actual lava flow from Hawaii, cast life-size in fiberglass. (See page 22 for an account of that process.) This flow is the basis for a "lava theatre," animated with special effects, including lights, television, and a soundtrack of native Hawaiian chants and stories about the fire goddess, Pele. Take a few moments to listen to these ancient tales; they have remarkable parallels with modern theories of plate tectonics.

As you leave the "lava theatre," you'll see a large mural of the Hawaiian Islands, a photo taken during a space shuttle flight. A map shows the Hawaiian chain, stretching from the Big Island to Kauai, to Midway, and finally to the submerged Emperor Seamounts. Over 90 million years, the Pacific Plate has carried these ancient islands far from the Hawaiian hot spot, all the way to the deep sea trench near the Aleutian Islands.

Nearby, you'll find more information on lava, and samples of its different forms: smooth, ropy *pahoehoe* (pah-HOE-ay-HOE-ay); chunks of rougher *'a'a* (AH-ah); black sand; green sand; and gleaming threads of *Pele's hair*. Labels tell you that, in deference to Hawaiian custom, the Museum no longer collects lava from Hawaii; these samples were collected nearly 100 years ago.

Highlighting the stages of island formation are touchable models, diagrams, and interactive elements. You can peek into a mutoscope (a nickelodeon-style viewer) where animated flip cards show volcanoes give way to coral islands, or turn a wheel to see a model of how the sea floor spreads. You can test your knowledge of Pacific geology with questions and answers on sliding panels: How hot is lava? How deep is the Pacific Ocean? What's Earth's tallest mountain? Maps and labels describe the formation of other kinds of islands: large continental islands, like New Guinea and New Zealand, and the island arcs—like Fiji, Tonga, and the Solomons—built by more explosive volcanoes in the Ring of Fire.

To learn more about the later stages of an island's life, visit the exhibit unit on coral. You'll find samples of coral to touch, and magnifiers to compare views of Pacific coral sand with Chicago beach sand. Specimens and diagrams show the structure of corals. The centerpiece of this area is a large marine aquarium with living corals and live Pacific reef fish.

Life Comes to Islands

After introducing the basic processes that form islands, the exhibit turns to the plants and animals that live on them. Here's where our title, *Traveling the Pacific*, really takes on meaning.

While most Pacific islands are very small, the ocean itself is vast—about 64 million square miles. It's widest near the equator, where it measures nearly half the distance around the world. The miles of open ocean that separate islands from continents, and islands from each other, have had an enormous impact on biological evolution and cultural history in the Pacific.

Remote islands start out as barren piles of volcanic rock. How do they become populated? The plants and animals that are settled there first must come from across the ocean—blowing in the winds, floating on the currents, or hitching a ride on some traveling seabird. Once they arrive, these visitors may not find accommodations suitable for survival. Here's a good example: Illinois has 44 kinds of native orchids. How many do you think are native to Hawaii? The answer: three!

Why so few? Orchid seeds are like fine powder, so they easily drift long distances on the wind. But to grow, orchids need nourishment from particular species of fungi that grow in the soil. Since the right fungi didn't get to Hawaii, very few orchids were able to set root there. These native Hawaiian species are very small. All the large, fancy orchids you see in Hawaii today were introduced by commercial growers.

While some organisms can't adapt to an island environment, others may find it a land of opportunity. Without competing species, their descendants can exploit a variety of ecological niches. Over many generations, these descendants might evolve into many new species, each adapted to a different lifestyle. Examples of this phenomenon, called adaptive radiation, abound on the Hawaiian islands. *Traveling the Pacific* includes specimens and photos such as snails, flies, birds, and plants. We'll show you how some island creatures lost ancient defenses: raspberries without thorns, plants without odor. You'll learn how imperiled some of these unique Hawaiian species are as you listen to the call of an extinct Hawaiian bird.

It takes many generations for creatures to evolve and diversify on an island during its early geological stages. But by the time the island has shrunk, sunk, and turned into a coral atoll it's populated by an entirely different set of organisms. These plants and animals must be adapted to survive a very rugged environment. On low coral islands the sun blazes and winds are forceful. The soil—what there is of it—is poor; levels of salt in groundwater and sea spray are high. The island may perhaps rise no more than ten or fifteen feet above sea level. The dry season can truly be a drought, and the wet season sometimes brings storms so violent they can sweep an island clean of life. In short, although it looks like paradise to us, real life on a picture-postcard beach is no vacation.

Artists Carol Christianson and Jeff Wrona painting ocean front side of recreated coral island. Ron Testa and Diane Alexander White

A Stroll in "Paradise"

There's no better way to learn about an environment than by going there. We can't take our visitors to a remote island, so we decided to bring an island to our visitors. After many months of research, fieldwork, design, and production, we've built an island within the Museum's walls. We're sure you'll find it a landmark experience to walk across the coral reef flat and leafy forest, out onto the sandy lagoon beach of an island in Jaluit Atoll. You're in the Marshall Islands, about 2,600 miles southwest of Hawaii.

This island is a tiny one, too small for human habitation. Its main residents are coconut, pandanus, and other tropical trees; bird's nest ferns and creeping vines; skinks, geckos and giant coconut crabs; noddies, terns, and tropicbirds.

You'll begin your hike on the exposed ocean side of the island. It's nearly sunset. A fresh wind blows in from the sea. The reef flat, exposed at low tide, stretches before you, littered with crabs, starfish, and chunks of dead coral. In the distant sea a line of breakers marks the edge of the underwater reef. You'll hear the constant, roaring surf and leaves rustling in the wind. Seabirds call from treetop perches; a reef heron feeds on the reef flat.

Follow a path to the interior of the island. There, you'll discover a group of exhibits—cases, labels, and hands-on models—inviting you to learn how creatures disperse to remote islands. A "wind machine" simulates dispersal on air currents; push down on its pumps and watch seeds swirl through the air. Slide open panels near a beached log to discover how it brings new life to islands. Dunk a coconut in water to see how it travels across the ocean to sprout on distant islands. Look closely at a seabird to find the seeds and snails that "hitched" a ride with him.

Continue your hike and emerge from the island center onto a lagoon beach gleaming with white sand and turquoise water. On this side of the island there's no surf, only the quiet lapping of waves along the beach's edge. Keep an eye out for reptiles and crustaceans, particularly giant coconut crabs, feeding on their favorite food.

People don't live on this tiny island, but they come here from other islands in Jaluit Atoll to gather resources like land crabs and fruits, and to fish from the offshore reefs. If you look around, you may find the remains of their picnic feast—charred shells, turtle bones, and coconut leaf plates. Pulled up on the sandy beach is their 18-foot-long outrigger sailing canoe.

Canoes in Pacific Cultures

Over many generations, canoe builders in the Marshall Islands developed designs and building methods well-suited to their austere environment. *Traveling the Pacific* highlights these achievements with exhibit labels that help you identify distinctive features of the canoe's hull, sail, and outrigger. We'll show you where to look at the hull to see how it's stitched together from many small planks; this technique enabled the canoe builder to make the most of scarce wood resources. Labels also point to the hull's unique asymmetric shape, explain how the outrigger works, and recount a Marshall Islands legend explaining how canoes got their sails.

Acquired with assistance from the Alele Museum of the Marshall Islands, this canoe is the only full-size vessel in the Field Museum's Pacific collection. It was built in 1977 and used until last year for fishing in Jaluit lagoon. (See page 24 for more information on the canoe.)

Many people in Chicago are boating enthusiasts, and might like to learn more about how Marshall Islanders build and sail canoes. That information is found in the exhibit in a thatched shed, similar to the one a Marshall Islands canoe builder might use to keep tools and materials sheltered from the hot sun or pouring rain. In the shed you'll find samples of those tools, and an unfinished canoe hull, showing how it's constructed. There's a working model of an outrigger canoe, demonstrating how it rides over ocean waves. Finally, you'll find information on centuries-old navigation techniques, using waves, clouds, birds, and stars as natural guideposts.

Leaving the canoe shed, visitors will find a display of arts and artifacts, all related to canoes, from throughout the Pacific. Unlike plants and animals, whose travel to far-flung islands was impeded by the Pacific's vast expanse, people transformed the seas from a barrier to a highway. In beautifully designed and engineered canoes, they colonized nearly every habitable island in this part of the world. Once people settled on islands, canoes enabled them to fish, trade, wage war, and simply keep in touch with their nearest neighbors.

We've assembled about 200 objects related to canoes from throughout the Pacific. Canoe models illustrate adaptations to different local environments: open ocean, coastal waters, inland rivers. Other models show canoes for war and trade. The display includes many functional items such as paddles and

bailers, but the true significance of canoes in Pacific cultures can best be measured by their use as ritual symbols. *Traveling the Pacific* includes many examples of ceremonial objects derived from canoes. Some are paddles, carried in dance. Others are headdresses, or dishes for food or oils.

The notion of voyage, represented by a canoe, could be a metaphor for major transitions that take place in human life. In some cultures, ritual canoes were made never to be sailed, but to be used only in initiation ceremonies marking the passage from youth to adulthood. One particularly beautiful example from the Museum's collections is a "spirit canoe" from New Britain. Canoes could also be used as coffins or grave markers, vessels for the voyage from this life to the next.

The First Settlers

Most of the Pacific islanders' voyages of discovery occurred before European ships ventured beyond the sight of land. New Guinea's first settlers arrived about 40,000 years ago, crossing at least 40 miles of ocean on some kind of watercraft. By AD 800, all the major Pacific islands were inhabited.

Since little physical evidence has survived, the details of Pacific prehistory aren't well known. Scholars agree that the islands were settled from southeast Asia—not from South America, a theory popularized by Thor Heyerdahl who sailed that way on his raft *Kon Tiki*. However, the exact number of migrations, and the paths of each, are still open to debate.

For two hundred years, western observers have divided islanders into groups called Melanesians, Micronesians, and Polynesians, basing the distinctions largely on physical appearance. But there's disagreement over how closely the darker-skinned Melanesians and the lighter-skinned Polynesians are related. *Traveling the Pacific* provides visitors with maps and labels describing the main theories of island settlement currently being debated.

What was it like to be an early Pacific voyager, to travel without maps or compass? To help give you some idea of the accomplishments of these great sailors, our staff has developed a computer game. You'll pretend to be the navigator of a canoe setting out from Samoa. You'll choose provisions, crew, direction to sail, and time of year. With skill and luck you'll reach another island. Without them, you might drift off course, perish in a storm, or simply run out of drinking water.

Breadfruit, *Artocarpus communis*, is a major staple food of the South Pacific. Introduced in prehistoric times from Malaysia, the breadfruit tree provides fiber for cloth, wood for furniture and canoes, and juices for caulking and glue, as well as foodstuff. A single tree, which may grow to 60 feet, can bear as many as 800 grapefruit-size fruits in one season. John Alderson

A New Guinea Village

After so much time at sea, visitors will perhaps be glad to set foot ashore. The next stop in *Traveling the Pacific* is a village on the Huon Gulf, on the northeast coast of the large island of New Guinea. Here, the sea supplies a bountiful harvest of fish, but resources of the land—garden crops and domesticated animals—play a larger role in sustaining human life. The environment here, and the traditional cultures that inhabited it, were entirely different from those on small islands like the ones we've seen so far.

Now, through exhibitry's magic, you'll travel back in time to 1910, when A.B. Lewis, a Field Museum curator, visited New Guinea and gathered thousands of objects to form the core of our unparalleled Pacific collection. We've selected several hundred of them to illustrate the roles that men and women played in Huon Gulf culture. Objects and photographs illustrate the cultural setting of 1910; labels point out continuities and contrasts with life today.

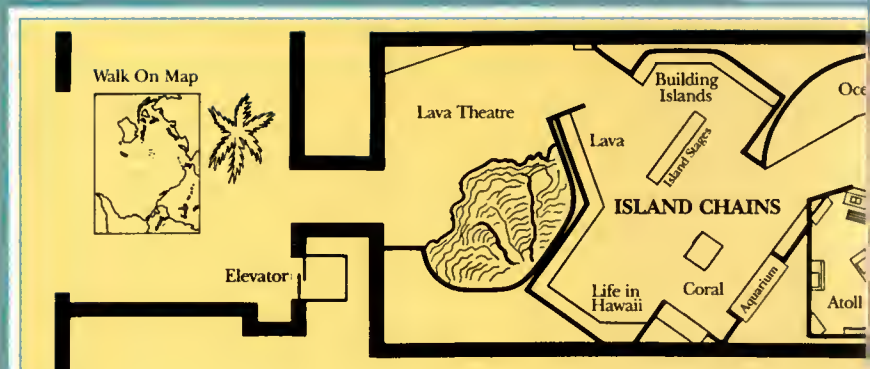
Continued on p. 19

TRAVELING THE PACIFIC

Would you like to —
see glowing lava?
walk on a windswept beach?
learn why some canoes have sails?
stroll through a traditional village
and a modern market?

Journey up to the second floor
and explore life on the Pacific islands
in the Field Museum's newest exhibit,
Traveling the Pacific.

On busy days, Museum members
go to the head of the line.



Coming next year:

Continue your travels through the cultural world of the P

Part 2 of our Pacific exhibit opens November 1990.

Northern Mariana Islands

Guam

Republic of Belau

Republic of the **Marshall Islands**

Federated States of Micronesia

Kiribati

Nauru

Papua New Guinea

Tuvalu

Tokelau

Wallis and Futuna

Huon Gulf

Western Samoa

Solomon Islands

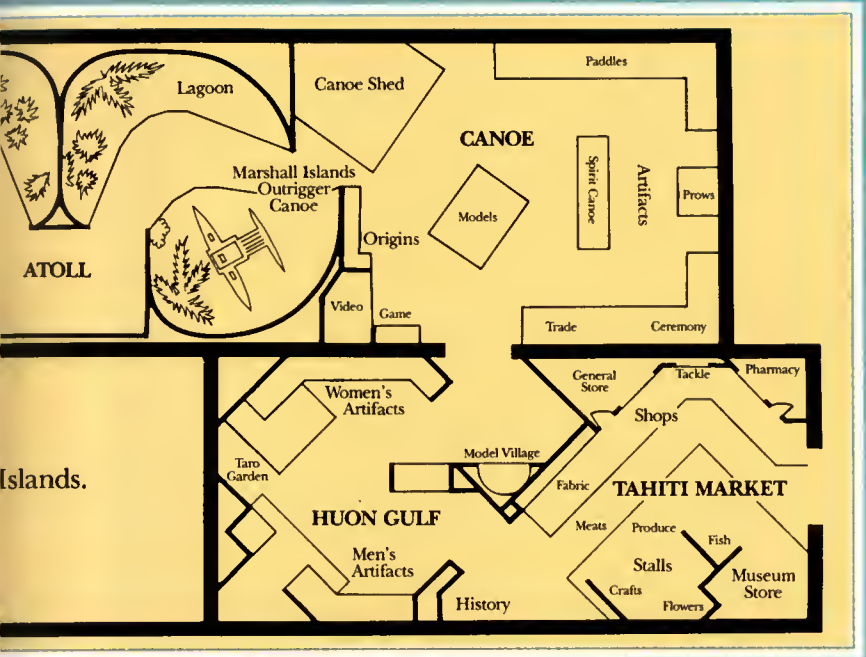
Vanuatu

Tonga

Fiji

New Caledonia

New Zealand



Chicago

Hawaii

Samoa

Cook Islands

Tahiti

French Polynesia

TRAVELING THE PACIFIC

Scale: Chicago to Hawaii - 4,233 miles

"Traveling the Pacific" was launched by...

Creating an exhibit is like undertaking an ocean voyage: it succeeds only through the combined talent and work of many people. We would like to thank those who have joined together during the past four years to complete the journey of *Traveling the Pacific.*

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November 1989

John Alderson

Urbanization comes to the Pacific. Today the Pacific's cultural and economic diversity includes scenes such as this in central Honolulu.

Continued from p. 14

Instead of building a life-size New Guinea environment, we've brought you this world in microcosm. Peek into a miniature diorama representing part of a Huon Gulf village as it might have appeared eighty years ago. Dwellings and a ceremonial house are clustered beneath a grove of coconut palms. Canoes for fishing and trading nestle on the beach. People work at their everyday tasks: men are planning a feast, chopping wood, spearfishing, and loading a canoe; women are making pottery and fiber bags, cooking, and caring for small children.

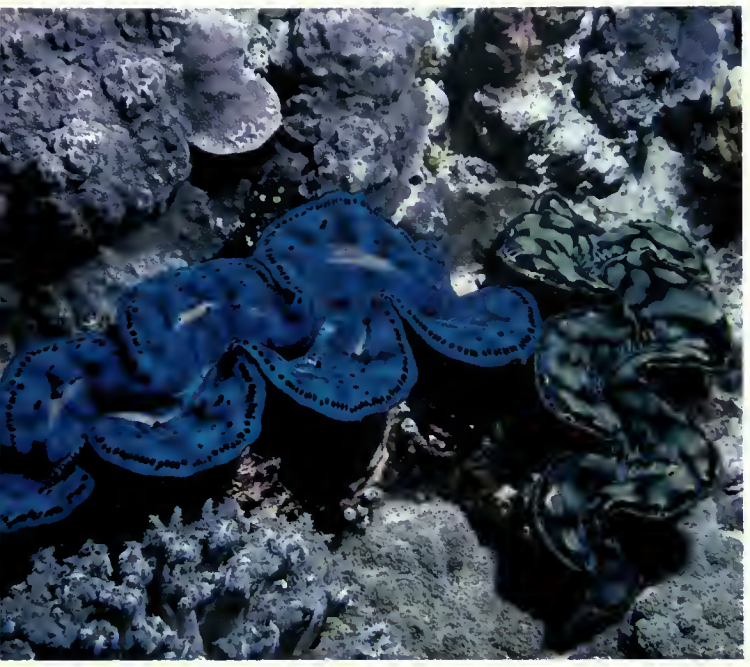
Artifacts in exhibit cases surrounding the diorama illustrate the complementary roles of Huon Gulf men and women. Facades for the cases look like full-size houses: a dwelling house on the women's side, and on the men's side a ceremonial house with some of its furnishings. Because rainfall is high in this part of New Guinea, these buildings stood atop house post "stilts." You'll have to look up to see the carved doorways, and imagine climbing notched log ladders to go inside.

Women's chief responsibilities centered on their homes and gardens: raising children and garden crops, making domestic goods like clothing and ceramics, and preparing daily meals. Men's encompassed a larger world. Trade, fishing, and warfare might have taken them miles from home. Only men could enter the ceremonial houses, where sacred carvings were kept, rituals planned, and local politics discussed.

Objects on display from the Huon Gulf include women's skirts and string bags, and a variety of men's ornaments. Stages in making a cooking pot are shown. Drums, bullroarers (wooden slats that "roar" when whirled), headrests, and figurative sculptures are shown near the ceremonial house. Highlighted are two of the most important foods: a replica garden of taro plants, and a real New Guinea pig, mounted by museum taxidermy. A hint of the preparations needed for a feast can be found in a recipe for taro and coconut cream pudding—to serve 100!

A Modern Market in Tahiti

The Museum's collection is rich in objects from the 19th and early 20th centuries, but life on Pacific islands has changed since then. Missionaries, colonial governments, the devastating battles of World War II, emergent nationalism, and the global economy have all played a role in creating today's Pacific. While many islanders continue to support themselves through fishing or agriculture, others live in urban settings. No longer using a subsistence economy, these islanders meet the needs of daily life through



Pair of giant clams (*Tridacna gigas*) in waters of the Caroline Islands. These huge molluscs, which can exceed 400 lbs., occur widely in the Pacific and Indian Oceans. The large adductor muscle is considered a delicacy. ©Carl Roessler

a modern economic institution, the commercial market.

To illustrate some of the continuities and changes in a contemporary culture, we've built a life-size recreation of one of the Pacific's most colorful markets, from Papeete on the island of Tahiti. (See page 26 to learn more about the design of the market.) This isn't a tourist market; it's where the Tahitians meet their material needs, and many social needs as well. Here they obtain their food and clothing, and gather to exchange news and views. Walk down a twisting street, glimpse into shop windows and open-air stalls. You'll find a record of the changing Pacific.

Some things in the market have been used for centuries: native crops like taro, breadfruit, and coconuts; ocean fish like bonito, and colorful lagoon reef fish. Other items are modifications of traditional Polynesian handwork: pandanus leaf baskets and hats and colorful shell necklaces. *Pareu*—sheets of fabric wrapped and folded to make a dress—are a centuries-old form of clothing. In their original form, they were made of finely beaten bark cloth; today, they're made from commercial cotton cloth colored in stenciled patterns.

While some continuities are evident, many changes in Tahitian society are also reflected in the market. Some signs are in Tahitian, but others are in French, as you might expect in this urban center of French Polynesia. Several of the shops have Chinese names. Woks and rice bowls are prominently displayed, and there's a Chinese-style pharmacy selling herbal medicines. The produce stall stocks Chinese foods like bean sprouts, ginger, and pea pods. You may be surprised to learn that the first Chinese people came to Tahiti in the mid-1800s, brought by European plantation owners to work the fields of cotton. They've remained to take an important place in today's Tahitian society and economy.

Changes in Pacific island material life are readily visible; less apparent to the casual visitor may be the underlying social values. Cotton may replace bark cloth, but 70 percent of Tahiti's people are native Polynesian speakers. A rich tradition of performing arts is still valued as cultural expression, not simply a means for tourist earnings. As the world approaches a new century, Tahitian people will continue to define and redefine their own culture, preserving what works from the past and adapting what they need for the future.

Preview of Pacific II

For the next year, visitors will exit *Traveling the Pacific* after their stop in the Tahitian market. In November 1990 we'll be opening the second and final phase of Field Museum's new Pacific installation. An additional 7,200 square feet of exhibit space will be devoted exclusively to displaying and celebrating some of the finest objects from our collection in an in-depth display of traditional Pacific arts and rituals. There will be more to see and learn about Polynesia and New Guinea, as well as memorial sculptures from New Ireland, unusual symbols of prestige from Vanuatu (formerly New Hebrides), and rare monumental masks from New Britain. Few museums can offer the public a new understanding of Pacific cultures; it's our goal to do so with the spectacular collection of Pacific artifacts now housed in storage at the Field Museum.

AUTHOR'S NOTE

Many people have contributed research and editorial skills to *Traveling the Pacific*, providing ideas and words that appear in the exhibit's label text. Some of them are borrowed for this article. I would like to acknowledge the contributions of the following individuals: Eileen Campbell, Susan Curran, Nora Deans, Richard Faron, Robert Feldman, Robert Izor, Peter Laraba, Judy Rand, and Michael Rigsby. Any errors of fact or interpretation that may appear in this article are, however, entirely my own.

Artifacts from Huon Gulf, Papua New Guinea: feather headdress (145943) and bull roarers—wooden slats that "roar" when whirled (144225, 146345, 146344, 138220, 146346). Diane Alexander White

A Recipe for Museum Lava:

Take 400 square feet of rock, add liberal quantities of latex. . .

by Tamara Biggs
Project Supervisor

Creation of the lava flow—just inside the entrance to "Traveling the Pacific"—began with a trip to the Big Island of Hawaii in February, 1988. We wanted to find out if we could collect material or find a suitable lava site to cast. It was our conviction that a lava flow belonged in the exhibit, since lava builds islands in the Pacific, and we knew about how big we wanted it. But that was all we had figured out.

One of our group suggested that we excavate part of a recent lava flow, package it, ship it to Field Museum and reassemble it; or better yet, lay a large plate of high-tempered steel in the path of an advancing flow, then just pick up the plate, full of lava, when the flow had cooled! After learning that it's against Hawaiian custom to remove lava from the islands, we decided instead to fabricate a fiberglass replica, cast from a mold of a real lava flow.

Early in March we began purchasing supplies for a mold-making trip to Hawaii, scheduled for May. Making a mold of 400 square feet of ground formation here on the mainland would have been challenge enough, but we were now faced with the additional problem of transporting our supplies across thousands of miles of ocean.

We bought small tools and supplies in Chicago and shipped them by air freight to Hawaii. The bulky materials which would become the finished mold were purchased in Los Angeles and shipped by barge to Hilo, Hawaii. Everything had to be on the dock in Los Angeles by April 18 to make it to Hilo in time. The situation seemed well in hand, with positive assurances from our Los Angeles suppliers until the day before the dock cut-off date. Then a supplier phoned to say a factory mishap had destroyed our latex rubber, but they would see what they could do by the next day. Somehow, the materials made it in time.

Exhibit preparator Pat Guizzetti and I arrived in

Preparing polyurethane foam jacket for Hawaiian lava flow mold (1988). Tamara Biggs

Active lava flow during Mauna Ulu eruption at Kilauea (1969-71). Shown here is the collapsed roof of a lava tube. Jeffery B. Judd

Hilo on May 8. The next day we met Tony Hlousek and Kurt Lemke, technicians we had hired to help us. We rented a U-Haul, a generator and a compressor and picked up our supplies. Then we drove to the home of Barbara Beardsley, a Hawaii resident and a Field Museum volunteer for the Education Department on her periodic trips to Chicago.

We had enlisted Barbara's help to find a lava site suitable for casting. We needed a flow that was not too old, because the lava's surface is fragile, brittle like glass, and quickly erodes. The site had to be near a road so we could drive our tools and supplies right up to it. Another stipulation was privacy: we did not want to attract the attention of residents or tourists, who might interfere with or damage our work. Barbara knew all the places to look. We spent the afternoon shopping for the perfect lava flow, and found it at our last stop. The lava we chose had an attractive "ropey" section right down the middle, and cracks and pillow shapes all around. The front edge looked like we could fashion it into the advancing front of lava crossing a road—the way we planned to exhibit it at the Museum. The road to the site was too rough for ordinary cars, but the truck could make it.

So, our first day's work was done. We had five more days to make 400 sq. ft. of mold and mold jacket, put together crates and pack them, move the crates to Hilo, then fly on to Majuro, Marshall Islands, some 2,500 miles to the southwest, for the next stage of our fieldwork. Other than being interrupted by rain a few times, and a momentary dread that a new active lava flow might come our way and destroy our work, things went fine. We did our best to placate Pele, goddess of the volcano, whom we acknowledged as responsible for our problems. We had heard that she could be placated with offerings of flower leis or gin or cigarettes. So every day we brought one of these items and did our best to present them in an acceptable fashion. Maybe it helped.

Our first task at the casting site was to remove loose fragments and debris from the surface of the flow with compressed air, making a clean surface for the latex rubber mold. The first and second layers of latex—a flexible material that could be pulled away from intricate shapes and undercuts—were thinly applied with a sprayer. The third layer was brushed on thickly. The fourth layer consisted of burlap impregnated with latex for added strength. The burlap was tediously applied in small squares. Then a final thick layer of more latex was brushed on.

Once the flexible mold was finished, polyurethane spray foam (commonly used for insulation) was applied on top to serve as a mold jacket. Since the latex mold was flexible, it would need the support of the rigid polyurethane to hold its shape when the casting was done.

Next we cut the foam jacket into four sections, pulled these off the mold, and cut the mold into four pieces along the same seams as the jacket. Pulling the mold from the lava was like a tug of war with a rope made of broken glass. The latex was firmly attached to the lava, clinging to every nook and cranny. Splinters of lava ended up in our fingers, though we wore gloves.

When jacket and mold sections were all removed we transported them to Barbara Beardsley's house, where her brothers, David and Bill, had built two crates the size of Chicago bungalows. Somehow the dimensions of the mold did not seem so great until translated into plywood and two-by-fours. We packed the molds and jackets into the crates, nailed them shut, loaded them onto a flatbed truck and waved goodbye.

Odyssey of a Marshall Islands Canoe

by Richard S. Faron
Assistant Developer

Field Museum's outrigger canoe on the beach at Jaluit Atoll, 1988. Tamara Biggs

Among our foremost concerns in planning "Traveling the Pacific" was to show the relationship that exists between many Pacific islanders and the ocean. To help illustrate this important affinity, the development team decided that an authentic Pacific sailing canoe should be in the exhibit.

We considered two types of canoe: a large, ocean-going type for covering great distances and a smaller type commonly used for tasks such as fishing, trading, and for island-hopping. After a great deal of research and lengthy discussion, we decided to get a smaller canoe, if possible, since it could more effectively illustrate the intimate relationship between Pacific islanders and their ocean. We were also guided by a very practical consideration: the smaller canoe would be far easier to ship to Chicago and set up in the exhibit.

At one time, smaller canoes, 20-30 feet long, were common on many Pacific islands. In many respects these sturdy craft were the local "pickup trucks," and were especially important for people living on the low-lying islands of coral atolls, where the ocean and its abundant resources were critical for survival. Today, islanders travel more often in power boats and even by plane; nonetheless, the canoe remains an important element in the day-to-day life of many Pacific people.

As we began our canoe search, a three-volume treatise in the Field Museum Library became an invaluable resource: *The Canoes of Oceania* (Honolulu, 1933), by A.C. Haddon and James Hornell. The authors describe in great detail the different types of sailing and paddling canoes of the Pacific islands, and make special note of the high level of refinement achieved by Micronesian canoe-builders, particularly those of the Marshall Islands where, they said, "the outrigger was brought to relative perfection."

The Marshall Islands consist of two parallel

chains of atolls some 2,000 miles southwest of Hawaii. The sailing canoes built there are single outrigger types with an oceanic lateen (triangular) sail. The canoe's lines and contours are dramatic because of the hull's asymmetry and an outrigger system that has both curved and straight booms. A testimonial to this elegantly designed craft was recorded in 1824 in the captain's log of the USS *Dolphin*: "Their canoes display the greatest ingenuity and I have no doubt that in any other country they would be ranked amongst the rarest specimens of human industry. They move through the water with astonishing velocity, and in turning to windward, no boats can surpass them."

The master of an early 19th-century schooner must have had ample reason to be so lavish in his praise, and we became even more convinced that a Marshall Islands outrigger canoe was just what we were after.

In May of 1987, with assistance from the Alele Museum of the Marshall Islands, I made a trip to that island group to see about getting a canoe. As I traveled among the atolls of Mili, Wotho, Ujae, Lae, and Alinglapalap, I studied and documented canoes currently in use. I also had long conversations at the Alele Museum with Arento Lobo, a canoe-builder and navigator from Kwajelein Atoll and with the Rev. Kanaki Amlej, historian-in-residence at the Alele Museum. With the kind and enthusiastic cooperation of these two canoe authorities, I gathered information on the materials and construction of traditional canoes; I also gained insights into the ancient and still-practiced art of navigating according to the movement of ocean swells.

During the next two years, with assistance from the Alele Museum staff and the Marshall Islands government, Field Museum was able to acquire an outrigger canoe on Jaluit Atoll. Through the good offices of the Alele Museum, the canoe was donated to the Field Museum, dismantled, created, and shipped to the United States. It took eight weeks for the canoe to reach the Museum, first by freighter to Seattle via Honululu, then by semitrailer truck to Chicago. The final leg of the trip was on the shoulders of eight Field Museum Staff members, who carried the uncrated canoe up the Museum's south steps.

This past year, a footnote was added to the canoe's historic odyssey: On September 15, the donated outrigger's former owner, Jima Jimna, and master canoe-builder Jenadde Leon flew from Jaluit to Chicago to reassemble the canoe in the exhibit hall. It has taken four years and 5,500 miles to see an idea realized, but a Pacific journey from west to east has been concluded in midwestern America. An outrigger canoe that once sailed the waters of the Marshall Islands has come to permanent rest at the Field Museum in "Traveling the Pacific."

Maori textile (88527) with incised canoe paddles on view in the exhibit. The top paddle is from New Zealand, the others are from the Austral Islands. Ron Testa and Diane Alexander White

Recreating a Tahitian Marketplace

by Jeff Hoke, *Exhibit Designer*

Lush, tropical mountains, cool aquamarine lagoons, and islanders dressed in colorful floral prints are some of the images that may come to mind when you think of Tahiti. And when approaching this group of islands by plane, they appear pristine, primeval, and unchanged. Upon landing in the island's largest city, Papeete, however, you are quickly reminded that Tahiti is in the twentieth century.

Papeete is a bustling metropolis of some 25,000 inhabitants and a crossroads for several cultures. The influence of French colonialism can be seen in the town's architecture and in the names of streets. Many of the shops bear the names of their Chinese proprietors, and among the crowd one sees Polynesian women wearing *pareus*, wrapped dresses decorated with colorful patterns.

There is rock and roll music blaring from car radios and "boom boxes" throughout the crowded streets, and the latest movies can be rented on video. But there is also traditional dance to be seen and music to be heard, and people weaving items from pandanus and palm leaves as they have for hundreds of years. All these elements come together in Papeete's central market—the inspiration for a replica on view in the Field Museum's new exhibit, "Traveling the Pacific."

As you walk through the exhibit, you are introduced to the natural history of the Pacific area, and a portion of the Museum's anthropology collection. Since our collections date from 1900 and earlier, there is little opportunity for visitors to see cultures in a present-day setting. By recreating the marketplace from Papeete, we have the opportunity to show a contemporary view of the mix of traditional Tahitian, European, and Asian cultures.

Upon entering the space, visitors are first confronted by the towering structure of a tin-roofed marketplace. Wandering through the arcades, there are stalls displaying meats, local fish, ancient Polynesian food crops, along with Chinese and European vegetables. Nearby are tropical flowers for sale and a stand of locally crafted items. Across the street is a row of shops that reflect some of the French colonial influence, with covered walkways and decorative railings.

Walking under the balcony, visitors first pass the window of a boutique, with displays of colorful imported fabrics with "tropical" designs. In the store's doorway, Museum visitors can try on a traditional Tahitian pareu. Next door to the fabric store, you can peep into a general store stuffed with French, Chinese, and Tahitian items—with many familiar objects displayed alongside unfamiliar items. The shopkeeper's radio blares out a beat of rock music with a Tahitian touch. Passing down the sidewalk, you can look into the window of a tackle shop to see a display of fishing gear used to catch local sea life. Handmade spear guns, nets, and traps are offered, in addition to a colorful display of odd-looking fishing lures used to attract a wide variety of fish, eel, and octopus. At the end of the block is a Chinese pharmacy. Through the doorway, you can see shelves lined with imported medicines and bins of hand-prepared remedies that have been carefully measured and packaged by the pharmacist.

To recreate a corner of Papeete in the middle of Chicago, we first depended on the research efforts of Stanford University anthropologist Laura Jones, in addition to help from Papeete's museum director, Manouche LeHartel. Jones took time out from her own fieldwork in Tahiti to take hundreds of color photos—everything from panoramas of street scenes to details of walls and cracks in the sidewalks. She sent us back handicrafts, along with store-bought items and audio recordings made during Papeete's market day.

All these elaborate preparations, however, would not have been enough without the efforts and enthusiasm of the Museum's production staff to translate and recreate the marketplace environment from the sources we gave them.

Museum preparators Dan Brinkmeier, George Chavez, Doug Jewell, Bruce Scherting, and Robin Whatley, among others, were given the task of recreating the marketplace. The goal was to build not just a simple structure, but to create an illusion of an urban environment weathered by wind and rain and give the impression of decades of use by Papeete's inhabitants.

The model for Field Museum's Tahitian market: Papeete storefronts (1988). Phyllis Rabineau

Flower and butcher stalls at Papeete market. Phyllis Rabineau

Much of the town's storefront facade was contructed from materials scavenged from local dumps in Chicago—one, a junk-strewn field where the stockyards once stood, another a large dump near Chinatown, as well as a huge illegal garbage dump within sight of the Field Museum. As early as January, lead preparator Brinkmeier and his crew were often out poking around the dumps, slogging through the snow, choosing a choice board here, selecting the perfect piece of sewer pipe there, then hauling their treasures back to the Museum.

On one of their early collecting forays, Brinkmeier observed a police car nearby. Worried that the policeman inside would think he was illegally dumping junk, Brinkmeier went over to explain his mission. The policeman rolled down his window an inch or two, and Brinkmeier began describing in detail the task of replicating a Tahitian marketplace in a natural history museum. Before Brinkmeier could finish, the officer slowly rolled up his window. "After that, I've never tried to explain to anyone what I was up to," says Brinkmeier.

The preparators' gathering trips also took them across the state, from a farm in northwestern Illinois to a site in downstate Pontiac, where they gathered rusted roofing tin.

Detailed replicas were needed to complete the market stalls. Preparators George Monley and Andrea Stanislav made fresh-looking fish, mouth-watering chunks of meat, and garden produce, through casting and painting techniques. Among the interesting techniques they devised was squirting hot glue into a bowl of swirling water, thus recreating the translucent, crisp strands of Chinese bean sprouts that are displayed in the marketplace's vegetable stand.

Through their expertise in painting, carpentry, and sculpture, the production team created a living environment that transcends the Museum walls, transporting the visitor thousands of miles away to experience the sights and sounds of Papeete.

The architecture around the marketplace reflects Tahiti's history of French colonialism, and many of the shops show the influence of Chinese commerce; but the market itself, though not traditionally Tahitian, is used today primarily by Tahitians. It is a place where Tahitian culture and craft thrives amidst the changes brought on by the 20th century.

Even though the marketplace's contemporary setting did not allow us to include artifacts from the Museum's collections, craft items shown in the market and stores were bought by anthropologist Jones in Tahiti, and as such can be considered contemporary artifacts, whose importance will only increase with time.

Change is constantly taking place in Tahiti, and this exhibit may be one measure of that change. Shortly after we began construction of our exhibit, the colonial structure in Papeete on which we modeled our own market was demolished and replaced with a modern structure on the same site. Our marketplace at the Museum is already a reminder of the constantly changing world we live in, a measure of the past.

The marketplace environment we've recreated within the Field Museum's walls has barely been finished, and it already reflects an isolated moment in time. In the future, the exhibit's importance as a "time capsule" will increase, evoking one time and place in the evolution of people and cultures across the Pacific.

Hawaii.
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UNITED
AIRLINES

FIELD MUSEUM TOURS

Legendary Shores
Turkey and
The Greek Islands

April 26 - May 7, 1990

Cruise and Land Fares
$3,395 - $4,545
Add air fare from Chicago - $600

Leader: William C. Burger, Ph.D.

Today, as in ancient times, the legendary Aegean is best appreciated from the sea. On this comprehensive itinerary we cruise in comfort and elegance aboard the *Illiria* to resplendent cities, idyllic islands, and ancient sites set against blue waters: Istanbul, Santorini, Ephesus, Crete, Mykonos, Rhodes, and Lesbos. Enhancing our voyage will be the team of expert lecturers, who bring the complex history of the region to life. Field Museum has selected Dr. William C. Burger, curator of vascular plants and a former chairman of the Botany Department to accompany our group. He will provide authoritative commentary on the plant life of the region and other aspects of natural history. Dr. Burger is also a highly skilled, widely published photographer who has taught courses in nature photography at Field Museum. He will be ready to share this special expertise with tour members as well.

We hope you will join us this spring as we visit these historic sites where western civilization was born.

Amazon
Jungle Rivers of South America: Puerto Ordaz, Venezuela to Manaus, Brazil

April 10-25, 1990

Cruise Price: $4,940 - $7,100
on the *Society Explorer*
Add International air fare from Miami: $600

Leader: Barry Chernoff, Ph.D.

Our adventure along the Orinoco River into the heart of the Venezuelan jungle is an exceptional experience. You will pass through some of the most vast and virgin wilderness of Venezuela. Dr. Chernoff, an ichthyologist who has done much of his research in this area, is looking forward to sharing his expertise as we explore the river's tributaries. We will take a special flight over the world's highest waterfalls, Angel Falls. After stopping at Devil's Island, visiting the eerie ruins of this former French penal colony, now partly reclaimed by the jungle, we cross the equator at the mouth of the mighty Amazon River and begin our exploration upriver. Each day we will make excursions in Zodiac landing craft, which make it possible for us to visit isolated villages, view colorful birds and butterflies, fish for unusual species, and take hikes into the jungle itself. Join us for an adventure to two of the world's greatest rivers.

Egypt
And Nile Cruise By Yacht

February 9 - 27, 1990

Price: $4,595
(includes land, cruise, and air fare)

Leader: Joseph G. Manning, Egyptologist

Egypt's ancient past still lives. You, too, can follow its past as we journey from bustling Cairo, with its renowned Egyptian Museum, its mosques, minarets, and markets into the ghostly silence of ruined cities, splendrous temples, Tut's tomb, and nobles' tombs. The 5,000-year-old Step Pyramid, the massive stone ruins of Karnak, and the Colossi of Memnon all beckon the curious and inspire respect for a culture as old as Western civilization itself. You'll appreciate the close observation of age-old scenes along the shore as you cruise from Luxor to Edfu, Kom Ombo, and Aswan.

Life in the fertile Nile Valley has changed very little. You'll enjoy air transportation from Chicago on Swissair, rated the world's best airline, Nile-view rooms at the five-star Semiramis Intercontinental Hotel in Cairo, accommodations at the superb Oberoi Hotel in Aswan, and cruising on board the M.S. *Nile Sovereign*, the newest and most luxurious river cruiser. Your exploration of this ancient civilization will be greatly enhanced by special lectures, and rare insights into the people and their culture as Joseph Manning (Egyptologist) and Ismail Mohammed Ali (resident guide–archaeologist) share their expertise with you. We hope you will decide to join us.

Crow Canyon

September 16 - 22, 1990

Field Museum tours will be conducting an exciting tour to Denver's Crow Canyon Archaeological Center. The tour will offer a splendid opportunity not only to view, but to participate in an archaeological dig. At Crow Canyon you encounter the excitement of archaeology first hand. Here adults and students of all ages—most with no previous archaeological experience—excavate, analyze, and learn side by side with archaeologists.

Together you and the Crow Canyon scientists work toward an understanding of the Anasazi, the "Ancient Ones," who built countless stone pueblos centuries ago, and then departed. In this beautiful southwestern landscape they left villages, ceramics, tools, and silence. At Crow Canyon you help widen our knowledge of these early Americans.

Kenya/Tanzania Safari

February 18 - March 11, 1990
$6,300
(includes air fare)

Leader: Audrey J. Faden

This safari is planned to show you Kenya/Tanzania's wildlife, its people, and all the spectacle of its magnificent scenery, and at the same time enjoy excellent facilities and travel in up-to-date safari vehicles. You will depart from Chicago O'Hare on a British Airways flight, stopping in London before continuing on to Nairobi, where you will stay at the famous old colonial landmark Norfolk Hotel. Then proceed to Amboseli National Park, justly famous for big game and superb view of Mount Kilimanjaro. Next cross the border to Tanzania and spend the night at Gibb's Farm. You then travel on to the renowned Serengeti National Park, unequaled in natural beauty. Here millions of wildebeest and zebra mill across the plains in their annual migratory search for fresh grasses. You may see large prides of lion; perhaps a leopard; groups of hyena, gazelle; topi and kongoni—the list is endless.

Your next destination is perhaps your most memorable: the Ngorongoro Crater. This great caldera contains some of the finest black-maned lion in Africa, rhino, eland, and dozens of other species. Next move to Lake Manyara National Park located in Africa's Great Rift Valley. The park is small, but rich, and is home to tree-climbing Tanzanian lions, great herds of elephant and hippo. Also, many water birds, including ducks, pelicans, and flamingos. You leave Tanzania, returning briefly to Nairobi before moving on to Abedare National Park and to the ARK, where you watch animals in complete comfort—-day and night—from a ground-level lounge with large picture windows. As you continue on to the Northern game park of Samburu, your game viewing takes you through a variety of landscapes, and is home to several species found only in these northern areas. After a night at the luxurious and renowned Mt. Kenya Safari Club, you return to Nairobi, later board an Air Kenya flight to the Masai Mara Game Reserve with its unmatched variety of game. Here you will experience a stay in a luxury tented camp.

Audrey Faden will accompany the small group from Chicago; her knowledge, enthusiasm, experience, and companionship will add immeasurably to your enjoyment of this unforgettable wildlife experience. We invite you to join us

The Galapagos Islands

March 2 - 13, 1990

Leader: John Flynn, Ph.D.

On many world maps it's difficult to find the tiny specks which appear off the coast of Ecuador in the Pacific Ocean. Yet, the Galapagos Islands are unique in their isolation. They contain mountains, forests, beaches, and bays unlike any others on earth. These islands lie 600 miles west of Ecuador, 800 miles south of Panama and almost 3,000 miles east of the nearest Pacific landmass. Most are relatively isolated from one another; a perfect setting for the evolutionary lab they would eventually become.

The first land inhabitants were windblown seeds that drifted into lava crevices and took root. The next were birds, perhaps also windblown, who stayed to breed. The last were reptiles, mainly lizards and iguanas, who rode tangled mats of river vegetation cast off the South American coast. But there the trend stopped. Few mammals arrived, and none who did was a predator. The result was a world which resembles earth's past. Birds ruled the air, reptiles the land. Furthermore, since there were no hunters, most species lived in peace. Life on these islands remains very much the same today.

We invite you to explore with us one of the world's greatest living laboratories of natural history. The primeval beauty of the area's colorful landscapes and wildlife excite the senses, and the remarkable tameness of the animals affords superb opportunities for wildlife study and photography.

We will fly from Chicago to Quito, Ecuador for three days, then on to Guayaquil/Baltra, where we will board the beautiful MV *Santa Cruz* and cruise comfortably to the islands of: Bartolome, Tower, Isabela, Femandina, North Seymout, Hood, Florena, Santa Cruz, and James.

Our stay in highland Ecuador provides a stimulating contrast in geology and wildlife. Dr. John Flynn, associate curator in the Department of Geology at Field Museum looks forward to sharing with you this unique experience unmatched by any other destination in the world.

Naturalist in Alaska

Circa July 10 - 25, 1990
(15-day tour)

Leader: David E. Willard, Ph.D., ornithologist
Accompanied by: Dan L. Wetzel, naturalist and tour operator

This expedition has been designed with an emphasis on education, for the person with keen interests and curiosities about the "real" Alaska. The 1,000-mile wilderness itinerary allows your personal interaction with the wildlife and wildlands of Alaska.

We begin our trip in Anchorage and move on to the Kenai Fjords, where we will experience the 38-foot bore tides, the second highest in the world, and a marked contrast to the one-foot tides of Prudhoe Bay where we complete our expedition. Our route includes Seward, Denali State Park, Denali National Park, Fairbanks, Coldfoot, and Sagavanirktok River. The Naturalist in Alaska Tour was created to bring the natural world of Alaska within your grasp. Let us send you more information about this unique opportunity.

TRAVELING THE PACIFIC

Win a trip to Hawaii during our Members' Previews!

Field Museum has named United Airlines the "Field Museum's Official Airline for *TRAVELING THE PACIFIC.*" This announcement is in recognition of a major promotional partnership between United and the Field Museum that will promote the Museum's new exhibit and United Airlines' service to the Pacific region. As part of the exhibit's opening festivities, United has donated a number of trips to its Pacific destinations. Three trips for two to Hawaii will be given away during the *TRAVELING THE PACIFIC* Members' Previews, November 7th, 8th, and 9th! Land packages and round-trip tickets for the trips will be arranged through United/United Vacations and Village Resorts and include accommodations at one of the following hotels: Islander on the Beach on Kauai, the Kiahuna Plantation on Kauai, or the Whaler on Maui. There will be a separate drawing held each preview evening. All Members over the age of 18 are eligible to enter the drawing when they attend the preview. Winners will be announced at the end of each evening.

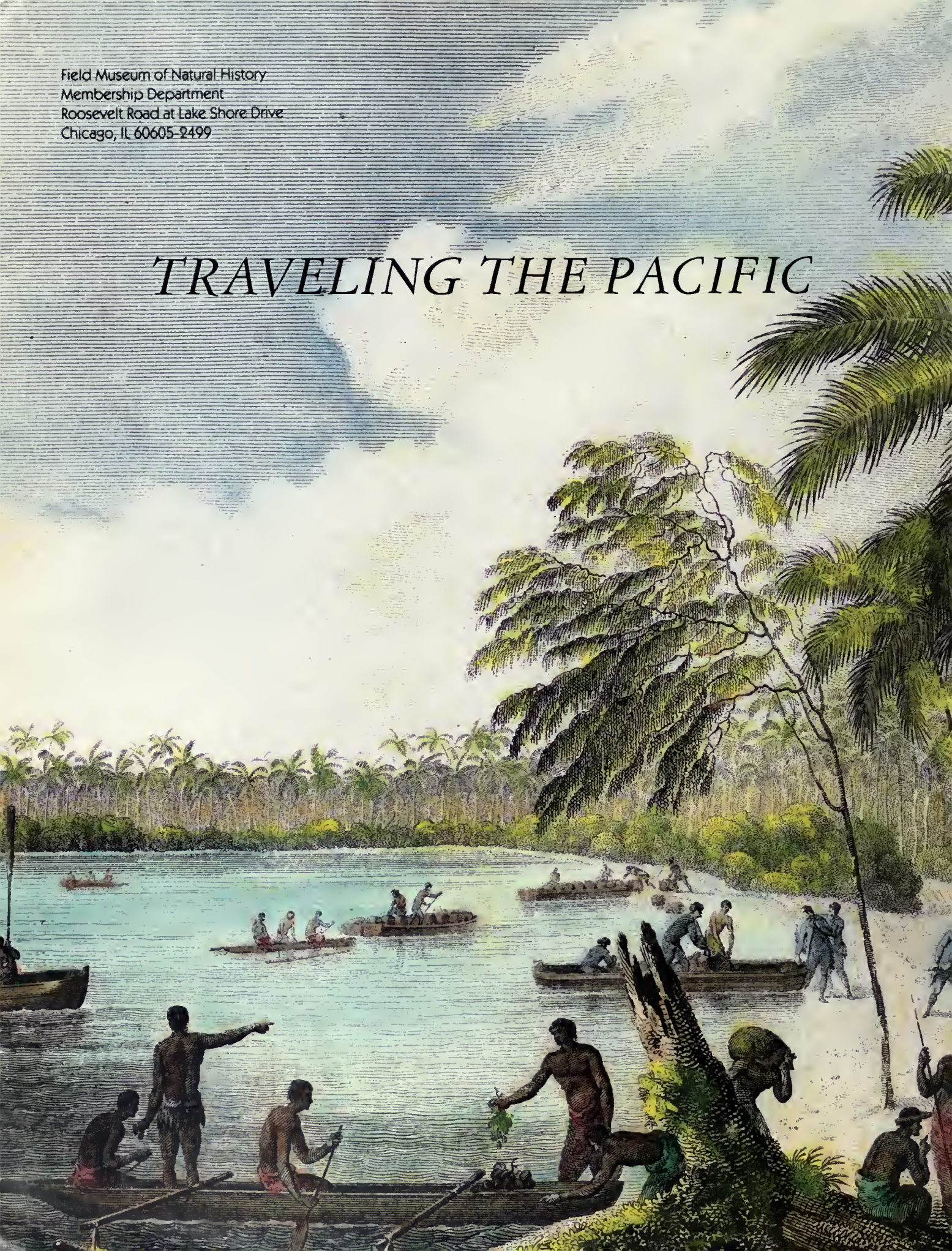
UNITED

PLEASE REQUEST INFORMATION ABOUT OUR BIKING TOUR THROUGH VERMONT, SEPTEMBER 23-30, 1990.

For reservations, call or write Dorothy Roder (322-8862), Tours Manager, Field Museum, Roosevelt Rd. at Lake Shore Dr., Chicago, IL 60605

Field Museum of Natural History
Membership Department
Roosevelt Road at Lake Shore Drive
Chicago, IL 60605-2499

TRAVELING THE PACIFIC



Field Museum of Natural History

Men's ornaments: String bag (decorated with dog teeth), hair combs, turtle shell bracelets. Huon Gulf, Morobe Province, Papua New Guinea.

November 1989

Marshall Field's

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
October 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	December 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31		1	2	3	4
5	6	7 *Election Day*	8	9	10	11 *Veterans Day*
12	13	14	15	16	17	18
19	20	21	22	23 *Thanksgiving Day*	24	25
26	27	28	29	30		

Ancestor figures and hand drum, carved and painted wood. Huon Gulf, Morobe Province, Papua New Guinea.

December 1989

Commonwealth Edison

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
November 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	January 1990 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31				1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23 *Hanukkah*
24 31	25 *Christmas Day*	26	27	28	29	30

Feather headdress. Huon Gulf, Morobe Province, Papua New Guinea.

January 1990

AON
Aon Corporation

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1 *New Year's Day*	2	3	4	5	6
7	8	9	10	11	12	13
14	15 *Martin Luther King, Jr.'s Birthday*	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

December 1989

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

February

				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28			

Bull roarers, carved wood. Huon Gulf, Morobe Province, Papua New Guinea.

February 1990

HELENE CURTIS

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
January 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	March 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31			1	2	3
4	5	6	7	8	9	10
11	12 *Lincoln's Birthday*	13	14 *St. Valentine's Day*	15	16	17
18	19 *Presidents' Day Observed*	20 *President's Day*	21	22 *Washington's Birthday*	23	24
25	26	27	28 *Ash Wednesday*			

Coconut cups (front-center), Carved coconut shells. Huon Gulf, Morobe Province, Papua New Guinea.
Food bowl (rear),carved and painted wood. Huon Gulf, Morobe Province, Papua New Guinea.

March 1990

bloomingdale's

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
February 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	April 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30			1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17 *St. Patrick's Day*
18	19	20	21	22	23	24
25	26	27	28	29	30	31

Prow ornament from a Spirit canoe. East New Britain Province, Papua New Guinea.

April 1990

S&C ELECTRIC COMPANY

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4	5	6	7
8 *Palm Sunday*	9	10 *Passover*	11	12	13 *Good Friday*	14
15 *Easter Sunday*	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

March

				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

May

		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Canoe shaped food bowls, carved wood and pearl shell inlay. Santa Anna Island, Solomon Islands.

May 1990

KRAFT GENERAL FOODS

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
April 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	June 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	1	2	3	4	5
6	7	8	9	10	11	12
13 *Mother's Day*	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28 *Memorial Day Observed*	29	30 *Memorial Day*	31		

Paddles (left to right): Canoe Paddle. Trobriand Islands, Milne Bay Province, Papua New Guinea; Ceremonial paddle. Austral Islands; Ceremonial paddle. Austral Islands; Ceremonial paddle. Maori, New Zealand.

June 1990

Mark Shale

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
May 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	July 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31				1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17 *Father's Day*	18	19	20	21	22	23
24	25	26	27	28	29	30

Canoe bailer, carved wood. Maori, New Zealand.

July 1990

Northern Trust Bank℠

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1	2	3	4 *Independence Day*	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

June

					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

August

			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Men's ornaments (left to right): Breast ornament, Cowrie shell, Nassa shell and feathers. Huon Gulf, Morobe Province, Papua New Guinea. Headdress; Cassowary feathers and Nassa shell. Huon Gulf, Morobe Province, Papua New Guinea.

August 1990

CONTINENTAL MATERIALS CORPORATION

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
July 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	September 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30		1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

Lime mortar, carved wood. Trobriand Islands, Milne Bay Province, Papua New Guinea.

September 1990

THE MARMON GROUP

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
August 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	October 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31					1
2	3 *Labor Day*	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20 *Rosh Hashanah*	21	22
23 30	24	25	26	27	28	29 *Yom Kippur*

Canoe prow, carved and painted wood. Admiralty Islands, Manus Province, Papua New Guinea.
(Bottom) Canoe model, carved and painted wood. Admiralty Islands, Manus Province, Papua New Guinea.

October 1990

American Appraisal Associates
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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
	1	2	3	4	5	6
7	8 *Columbus Day Observed*	9	10	11	12 *Columbus Day*	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31 *Halloween*			

September

						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

November

				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

Canoe model, carved and painted wood. West Sepik Province, Papua New Guinea.

November 1990

ANDERSEN CONSULTING
ARTHUR ANDERSEN & CO.

ARTHUR ANDERSEN &CO

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
October 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	December 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 34 25 26 27 28 29 30 31			1	2	3
4	5	6 *Election Day*	7	8	9	10
11 *Veterans Day*	12	13	14	15	16	17
18	19	20	21	22 *Thanksgiving Day*	23	24
25	26	27	28	29	30	

Waka Huia (Feather Boxes), carved wood. Maori, New Zealand.

December 1990

morgan SERVICES INC.
Since 1887

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
November 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	January 1991 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31					1
2	3	4	5	6	7	8
9	10	11	12 *Hanukkah*	13	14	15
16	17	18	19	20	21	22
23 30	24 31	25 *Christmas Day*	26	27	28	29

Ceremonial headdress, carved and painted wood with feathers. Gogodala, Western Province, Papua New Guinea.

January 1991

RUDNICK & WOLFE

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
December 1990 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	February 1991 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28	1 *New Year's Day*	2	3	4	5
6	7	8	9	10	11	12
13	14	15 *Martin Luther King Jr.'s Birthday*	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

Field Museum of Natural History
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